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MAY, 1849.

CIVIL ENGINEERING.

Notice of the Report of the Railroad Corporations in the State of Massachusetts for 1848.

From the Salem, (Mass.,) Register, March 29, 1849.

The Annual Reports of the Railroad Corporations in the State of Massachusetts, published by order of the Legislature, have grown so much as to constitute quite a formidable volume. The reports for 1848, just published, with the comments and tables of the Legislative committee, cover about 220 pages, presenting a mass of railroad statistics truly astounding, when we consider how comparatively short the time is since the first railroad excited the wonder of the people of the good old Bay State.

It appears that returns have been made by thirty-seven corporations, with an aggregate capital of $50,264,100, of which amount $38,749,316·40 have been paid in. The total cost of these roads has been $46,886,991·93; the aggregate debt, after deducting the surplus fund, $11,070,971·11; the earnings, $6,067,154·02; the expense of working, $3,284,933·38; the net earnings, $2,716,920·30; the total dividends, $2,110,295·12.

The length of the main roads is 954⅓ miles; of branches, 88⅘—total miles a little more than 1043. More than 220 miles are furnished with a double track.

The average speed of passenger cars on the Massachusetts railroads is 23·13 miles per hour; that of freight cars, 12·35 miles per hour.

The casualties reported—56 killed, 65 injured.

During the past year, about 300 miles of railroad have been put in operation on the various lines leading to Boston, many of which are far from being completed.

The miles of railroad finished in New York, it is believed, do not exceed 750.

The whole number of miles in the United States is stated at 6421¼, of which nearly one-sixth part is in Massachusetts.

The extent of railroad finished in England, at the end of the year 1848, and in operation, was 4420 miles, constructed at a cost of £131,000,000 sterling, or $628,000,000. The average cost per mile is about $142,000.

These roads are thoroughly built, generally with two or more tracks.

There is no road in this country which cost the average of the English lines, excepting, perhaps, the Reading Railroad in Pennsylvania.

The traffic on the English roads in 1848, amounted to £10,092,000, or more than $47,000,000. The net returns were about $4\frac{34}{100}$ per cent. on the outlay.

The expense of working the English roads is less than 50 per cent. of the gross earnings.

The expense of working the Massachusetts roads is a fraction over 54 per cent.

Forty-three corporations, with an aggregate capital of $11,262,000, have made no returns. Some of these are newly chartered, and not yet in operation; in a large portion, no attempt at organization has been made, and some never will be built.

The Eastern Railroad reports miles run by the passenger trains during the year, 224,640; by freight trains, 33,696; by other trains, 13,640—total miles run, 271,976. Number of passengers carried in the cars, 1,021,169. Average rate of speed adopted for passenger trains, including stops, 21 miles per hour; for freight trains, including stops, 15 miles per hour.—Eight persons were killed and thirty-six injured, within the year—all but three of the casualties being occasioned by the terrible collision between the two extra trains, on the night of November 3.

The Essex Railroad was opened to Lawrence during the last summer. The number of miles run by passenger trains was 18,071; by freight trains 1166—total 19,237. Number of passengers carried, 89,569. Average rate of speed of passenger trains, 20 miles; freight trains, 15. No accident to individuals occurred.

The Committee have appended to the Reports a very convenient table, containing a list of the railroad charters granted from 1825 to 1848, both inclusive, with a succinct account of the legislation in regard to each—which will be found very useful for reference. The whole number of charters granted has been 101.

The transcript contains a tabular statement of the Railroads of Massachusetts and the adjoining States, from which it appears that, during the last three years, *seventeen millions* of passengers have been carried over them, and 109 fatal accidents have been reported, viz: 24 passengers, 32 employees, and 53 other persons.

The Committee point out several deficiencies in the returns, and complain that the requirements of the law are not fully complied with in many cases. Twenty corporations are named as presenting in their reports a substantial compliance with the law, and those of the Boston and Lowell,

Boston and Maine, Cheshire, Eastern, Fall River, and New Bedford and Taunton, are considered by the Committee as, in point of form, worthy of imitation. A strict compliance with the law is deemed to be of great importance, as, when the returns are fully systematized, they will present a body of useful and reliable railroad statistics.

Report of CHARLES H. HASWELL, ESQ., *Engineer-in-Chief, United States Navy, in regard to the use of* MR. J. B. EMERSON'S *Propeller in the service of the Government of the United States.*

NAVY DEPARTMENT, *February* 1, 1849.

SIR: Agreeably to your direction, I required the Bureau of Construction, Equipment, and Repair, to collect and communicate the information called for by the resolution of the Senate of the 15th of January ultimo, in regard to the use of J. B. Emerson's patented spiral propeller on vessels of the United States.

I have the honor to transmit a report from C. H. Haswell, Esq., Engineer-in Chief of the Navy, which contains the information asked for in a satisfactory form. I am not aware that Mr. Emerson's invention has been used in the Navy. No use has been made of a propeller in the Navy, except on the three vessels named in Mr. Haswell's report, and that contemplated on the new steamer "San Jacinto," yet unfinished.

I have the honor to be, very respectfully, your obedient servant,

J. Y. MASON.

To the PRESIDENT.

WAR DEPARTMENT, *January* 25, 1849.

SIR: I send you a resolution which the President has referred to the Treasury, War, and Navy Departments. I have seen a report by the Chief Engineer of the Navy department, which I think covers the whole case. It refers to the vessels in the War and Treasury Departments which use propellers, and discusses the claim of Mr. Emerson, and furnishes all the information which the President may need to answer the resolution.

Respectfully, your obedient servant,

W. L. MARCY,
Secretary of War.

Hon. R. J. WALKER,
Secretary of the Treasury.

OFFICE OF ENGINEER-IN-CHIEF, U. S. N., *January* 30, 1849.

SIR: I have the honor, in compliance with your direction, to submit the following report, in regard to the use of Mr. J. B. Emerson's propeller in the service of the government of the United States, as called for by the Secretary of the Navy.

Mr. Emerson has made claim for patent fees, for the use of his invention, for twenty-eight propellers in the service of the United States. Of them, four only are or have been owned by the Navy Department, viz: the

Princeton, Water Witch, Scourge, and the steamer now in progress of construction at the Navy Yard, Brooklyn.

Seventeen were built or purchased by the Quartermaster General, for the use of his department, viz: the Eudora, McKim, Edith, Washington, Tompkins, Trumbull, Walker, Buchanan, Stevens, Virginia, Massachusetts, Ashland, Marcy, Stanton, J. R. Thompson, Mason, and the James Cage.

Three were built by the Treasury Department, viz: the Legare, Jefferson, and Spencer; one is a duplicate charge, the Bangor, being the original name of the Scourge, and the remaining three are unknown in any of the departments of the public service, as far as I have been able to ascertain.

Of those employed by the Navy Department, the Princeton, when first constructed, had an Ericsson *screw* propeller; at this time she has a Stevens scull.

The Water Witch, for a brief period, had two of Loper's *flat bladed* propellers. The Scourge, purchased by the Department in 1847, and sold in 1848, also had two of Loper's *flat bladed* propellers, and the San Jacinto is to have a screw propeller, the design for the construction of which is not yet made.

As to the propriety of the memorialist's preferring a claim at this time, it appears that a suit instituted by him against Hogg and Delamater, of New York, for the manufacture of Ericsson's propeller, as an alleged violation of his right, has been pending with varying results in the courts of New York, for some four years, and is now referred to, and awaits the final action of, the Supreme Court of the United States.

Howard's Reports, referred to by the memorialist, (at page 2,) shews that the judgment in the case cited was suspended, and on making inquiries in the proper quarter, I learn that no disposition has yet been made of it.

In the absence, then, of a judicial decision, as to the right of the memorialist in the instrument of Captain John Ericsson, and of any legal claim to the instrument of Captain R. F. Loper, it is proper to consider their claims as set forth in their several specifications, which must govern the letters patent granted to them by the Commissioner of Patents.

1. Claim and specification of Mr. J. B. Emerson, the memorialist, of March 8, 1834.

"I (also) claim the spiral propelling wheel, constructed and operating in the manner of which I have set forth," which is as follows: "This spiral I make by taking a piece of metal of such length as I intend the spiral propeller to be, and of a suitable width, say for example, eighteen inches; this I bend along the centre, so as to form the sides, say of nine inches in width, standing at right angles, or nearly so, to each other, and give to it longitudinally the spiral curvature which I wish. Of these pieces, I prepare two, three, or more, and fix them on to the outer end of the paddle shaft, by means of arms of a suitable length, say of two feet more or less, in such a position that the trough form, given to them longitudinally, shall be effective in acting upon the water."

2. Claim of Captain John Ericsson, February 1, 1838.

"I claim as my invention the metallic hoops or cylinders, and the spiral arms or spokes, herein before described, &c."

3. Claim of Captain R. F. Loper, February 28, 1844.

"I claim as my invention the before mentioned or described manner of constructing the propellers, by extending their inclined planes, or propelling surfaces of the paddles, into the hub or centre portion of the propeller, as set forth."

4. Claim of Captain John Ericsson, September 9, 1845.

"I claim as my invention the hub constructed with perforated projections, and the combination of the same with the elliptic braces, for the purpose of strengthening the spiral blades."

Thus, it appears that Mr. Emerson describes a particular construction of blade, of a trough form, supported by arms. The trough form is employed neither by Captain Ericsson nor Captain Loper, and this is the only novelty described by Mr. Emerson, as both arms and spiral planes, as distinguished from troughs, had been patented (B. M. Smith, 1829) and in use in wheels and propellers for many years.

Captain Ericsson claims the *hoop* or *cylinder*, and the *spiral arms* or *spokes*, as described; also, *perforated projections* on the *hub*, and *elliptic braces;* and Captain Loper claims the extending of the surfaces of *the blades into their hub.*

How these distinctions are to be reconciled, so as to concede to the memorialist the sole right to the use of the propeller referred to, I cannot for a moment imagine. It is true that Mr. Emerson, in express terms in his specification, claims the spiral propelling wheel in every form, and every thing on similar principles, producing similar results. In virtue, then, of his claim, as he has stated it, he would include Loper's, Ericsson's, and even the propeller about to be constructed for the San Jacinto. But it will be seen, by reference to the opinion delivered by the Supreme Court, annexed to Mr. Emerson's memorial, (page 8,) that the court say expressly, "that the inventor (Mr. Emerson) claims as his improvement, not the whole of the wheel, but merely in the new and superior form which he particularly sets out." Now it will be seen by reference to the several claims here cited, that the new and superior form of Mr. Emerson's propeller, viz: the two-sided blades of a trough form, is not, in any wise, approached in the other claims.

Further, the memorialist claims "a spiral propelling wheel, constructed and operating in the manner I have set forth, in which setting forth he does not once use the word *hoop*, *cylinder*, *perforated hub*, or *elliptic brace*, the patentable features of Ericsson's propellers; neither does he use the word *hub*, the peculiar construction of which alone constitutes the patentable features of Loper's propellers.

The pretence that Loper's propeller is an infringement, has never, to my knowledge, been set up in a court of justice. The claim to the San Jacinto propeller is the claim of a patentee, whose privilege has expired, to an article that has not yet been produced. The very general language of the memorialist's specification, and the interpretation that has been put on it by the courts in New York, would appear to have encouraged Mr. Emerson in the delusive idea that he is the inventor of the stern spiral screw propeller, whereas Stevens, Smith, Beard, and others, have anticipated him by many years, in all the novelties of his invention, except the *trough.*

It is proper that I should add here, that the drawing furnished by the memorialist has been certified as a part of his patent, but in a copy of a drawing on file in the patent office. It was filed, as I am informed, ten years after the issue of his patent, long after the inventions of Captains Ericsson and Loper had been introduced into public use, and long subsequent to the filing of a prior drawing, filed under the statute of 1837, which provides for the restoration of patents destroyed by the burning of the Patent Office of the preceding year; and which drawing must necessarily have been the one regarded by the Commissioner of Patents when he passed the several claims of Captains Ericsson and Loper.

Reviewing, then, the facts herein presented, it appears,

1st, That the memorialist claims "the spiral propelling wheel," not confined to forms, but so long "as similar results are produced by similar means."

2d, That the Supreme Court says he does not claim the whole of the wheel, but merely the new and superior form, which he particularly sets out, which is the *trough*.

3d, That the spiral propelling wheel was patented long before the issue of the memorialist's patent in 1834.

4th, That the novelties claimed by Emerson, Ericsson, and Loper, vary widely in their purposes and locations, in one common instrument.

5th, That of the 28 cases of alleged use of the memorialist's invention,

Four are where Ericsson's propeller of 1838 has been used,	4
One is where Ericsson's propeller of 1844 is in use, and to which the memorialist as yet has set up no legal claim,	1
Eighteen are for Loper's propeller,	18
One is where the propeller is not yet constructed,	1
And four are unknown,	4
	28

6th. That should the Supreme Court decide the case now before it in Mr. Emerson's favor, and thus establish that Captain Ericsson's propeller of 1838 is an invasion of Mr. Emerson's patent, and that as Mr. Emerson has recovered in the case carried to the Supreme Court, and now pending there, his patent fees for three of the vessels above enumerated, as using the propeller of 1838, his having once obtained satisfaction for his patent fees, it is difficult to understand upon what principle he can now call upon the United States to pay them a second time.

7th, That in the event, then of a decision by the Supreme Court favorable to the claims of the memorialist, he could alone claim a patent fee for the use of the propeller which was first used in the Princeton, and which was replaced by the Stevens's scull in 1844.

8th, That the judgment of the proper tribunal would be necessary to validate the memorialist's claim to the one case of Ericsson's propeller of 1844, and to the 18 cases of Loper's propeller, neither of which have yet been assailed in a court of justice, so far as I am enabled to ascertain.

9th, That the interests of the memorialist are not likely to be affected in the case of the San Jacinto's propeller, as it is not yet drawn, and will not assimilate to his description in any one feature; added to which, the

patent right under which he claims $15,000 fees, in this prospective violation, expired on the 8th of March last.

Further, I am not aware that any propeller has ever been built resembling that described by the memorialist in his specification; in fact, the application of one constructed in accordance with his specification is, in my opinion, positively impracticable for useful purposes.

I am, respectfully, yours, &c.,

CHARLES H. HASWELL.

To CHARLES WM. SKINNER,
Chief of Bureau of Construction, Washington, D. C.

Description of Improvements in Constructing Bridges, Aqueducts, and similar structures, patented by JOHN HARVEY SADLER, *of Holbeck, Leeds, (England,) July 7th,* 1847.

This invention relates chiefly to the construction of bridges, aqueducts, and viaducts, with cast iron girders; it also embraces some improvements in the construction of railways.

In Plate II, fig. 1 is a side elevation of part of a bridge, viaduct, or aqueduct, made, according to this invention, of cast iron girders, strongly jointed and bolted together at *a*, and resting on brick or stone piers *b;* each part *c*, c^1, of the girders being cast from the same pattern; or, where the girder is not required to be of great length, the two parts *c*, c^1, may be cast in one piece; in either case each girder will extend from the centre of one arch to the centre of the next, and the two parts, on either side of a pier *b*, will balance each other; consequently there will be but little weight or "sway" at the centre of each arch. The adjacent ends of the girders are connected together by means of two plates *d*, having projections on their inner sides, fitting into corresponding grooves formed on the sides of the extremities of each girder, as shewn at c^2; and the plates *d*, are fastened together by bolts passing through slots in the girder: this mode of connecting the ends of the girders admits of the girders being expanded or contracted by changes of temperature without injury. Fig. 2 is a transverse section, on an enlarged scale, of two plates *d*, with the end of the girder between them. Fig. 3, is a plan view of the cast iron covering or flooring, which the patentee proposes to apply to bridges, &c. Fig. 4 is a plan view of the under side of the two kinds of plates *e*, *f*, used in forming the flooring; and fig. 5 is an edge view, shewing how the plates are secured to the girders *c*,—both these views being on a larger scale than fig. 3.—The plates *e*, on which the chairs for supporting the rails (*g*, fig. 3,) of the railway are bolted, have three ribs on the under side, in order to give the requisite strength, and holes are formed through them, to receive the bolts employed for securing the chairs. The plates *f*, which are not required to be so strong as the plates *e*, have only two ribs on their under side. On each side of every plate two square studs *h*, and two corresponding recesses are formed; so that the studs on each plate will enter the recesses

in the adjacent plates; while, at the same time, the studs on the latter plates will enter the recesses in the sides of the first-mentioned plate. At the extremities of each flooring plate, on its upper side, are flanches, having holes formed in them to receive bolts, by which they are secured to corresponding flanches *i*, on the girders *c*.

Fig. 6 is a transverse section of another arrangement, shewing a method of fixing girders for railway carriages to run upon, instead of the ordinary rails. *j*, *j*, are the outside girders, standing higher than the rail girders, and thus acting as walls to bridges, viaducts, or elevated railways; *k*, *k*, are the rail girders, cast with strong and thick upper edges for the wheels to travel upon; *l*, *l*, are stays of cast or wrought iron, fixed at such distances apart as may be required for keeping the rail girders securely in their places; and *m*, is a flooring of boards, resting on flanches cast upon the girders to receive them.

Fig. 7 is a side view of part of a railway made of cast iron girders, connected by stays, similar to *l*, fig. 6; the ends of the girders, at *d*, being connected by plain or toothed plates, in the manner represented at figs. 1 and 2. The patentee says, "such arrangement may be used to very great advantage over a tolerably level country, inasmuch as a railway to any considerable distance may be erected at once for traffic; and, if thought necessary, embankments, &c., could be made at any time afterwards: thus, a railway in different portions of the line could be opened, and earning money during the time that the deeper cuttings, tunnels, &c., are effected."

Lond. Jour. Arts, Vol. 32.

Sadler's Patent Balance Bridge.

In the Mining Journal of the 19th August last, we gave a short notice of a bridge, on an entirely new construction, the invention of Mr. Sadler, of Leeds, a model of which we had then inspected. A larger model is now, we understand, being exhibited at Shott's Iron Foundary, St. Enoch's Square, Glasgow. The idea of the principle of this bridge occurred to the patentee immediately after the fatal fall of the Chester and Holyhead Railway Bridge over the Dee; it occurred to him that, as cast iron arch girders, above a certain span, contained so much metal that they could not safely carry much more than their own weight, it would be a great improvement to cast them in the form of two half arches, the centre resting on a pier; this plan he has carried out in the model in question. The ends of the castings, which when fixed form the centre or key of the arch, are furnished with a series of teeth or projections, similar to a cog wheel, and which, when brought together, fit truly into each other; a plate of iron is then fixed over the joint, and the two ends bolted up securely together. By this arrangement, whatever deflexion there may be on one end of any one of these levers, from the superincumbent weight, it is distributed, by the action of these balance girders, to the next arch on each side, and by them to the next, and so on throughout the length of the bridge, the whole forming a set of compound levers; and while the weight of a train is bearing directly on any one of the arches, a portion of that weight is sent, in

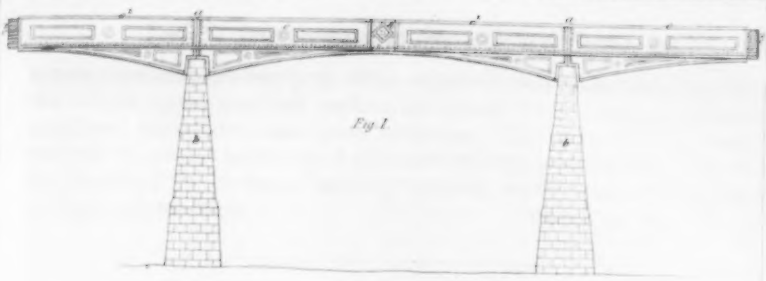
Fig. 1.

Fig. 7.

Fig. 4.

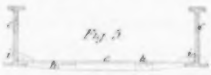
Fig. 5.

Fig. 6.

Fig. 3.

Fig. 2.

Fig. 13.

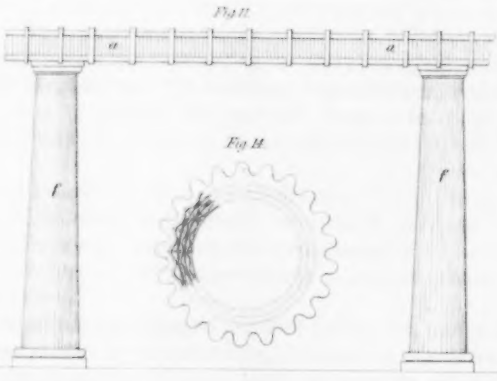
Fig. 11.

Fig. 14.

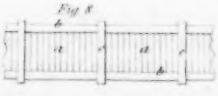
Fig. 8.

Fig. 9.

Fig. 10.

Fig. 13.

Fig. 12.

a wavy manner, to every part of the structure; and when, with long trains, the weight rests on several arches, the whole is beautifully regulated and equalized throughout the entire structure. The principle has been examined by several engineers of extensive railway practice, and pronounced faultless, and to be most perfectly adapted to the purposes of railway bridges and viaducts. Lond. Min. Journ, No. 699.

Description of Improvements in Iron Girders, Beams, Trusses, and Supports, and in rendering the Floors of Buildings Fire Proof by the use of Iron; patented by JOHN HENDERSON PORTER, *of the county of Kent, (England,) March 8th*, 1848.

This invention consists, firstly, in the application of corrugated iron to the construction of girders, beams, trusses, or supports generally, (whether the corrugations be in curved lines or in angular lines, forming parts of cylinders or tubes, and resisting compression in the direction of their length;) and, secondly, in a particular application of the corrugated iron, (in which the corrugations of the plates are caused to assume both vertical and horizontal positions,) to render the floors of buildings fire proof.

In Plate II, fig. 8 is a side elevation of a beam, constructed according to this invention; and fig. 9 is a transverse vertical section of the same. *a* is a plate of corrugated iron, on the top and bottom edges of which the caps or frames *b*, of wrought angle iron, are placed, and the wrought iron bands *c*, are shrunk upon them; and then, to complete the beam, rivets may be passed through the frames *b*, and bands *c*, where it may be thought desirable. The patentee remarks that such a beam becomes a beam, girder, truss, or support, according as it is used for one purpose or the other in the construction of a building. Sometimes, instead of using the angle iron caps or frames *b*, the patentee forms a beam by combining bars of wrought T-iron, shewn at *d*, in the section fig. 10, with two corrugated plates *a*.

Fig. 11 is a side elevation of a girder, constructed according to the plan above described, with the addition of a third plate of corrugated iron, placed with its corrugations in a horizontal position, between the other two plates, (which have their corrugations in a vertical position,) and rivetted or bolted to them.

Fig. 12 exhibits an enlarged view of the girder, partly in plan view and partly in horizontal section; and fig. 13 is a transverse vertical section of the same, also upon an enlarged scale, in order to exhibit the parts more clearly—in these figures, *e* is the third plate, which is fixed, with its corrugations in a horizontal position, between the two plates *a*, *a*. The girder is shewn supported by two pillars *f*, *f*, constructed of corrugated iron, according to this invention, in the manner represented by fig. 14, which is a horizontal section of one of the pillars upon an enlarged scale. The bodies of lighthouses and windmills, and chimney shafts, may be constructed in this manner. An arched girder may also be formed of corrugated plates, combined with bars of T-iron; the corrugations of all the plates used in constructing this girder may be made to radiate from the centre of the

circle of which the under side of the girder is an arc; or the corrugations of the plates on one side of the girder may be placed in the reverse direction to those on the other side; and the bands may be drawn tight by nuts and screws, instead of being shrunk on.

The method of constructing fire-proof floors for buildings is represented at fig. 15, which is a transverse vertical section of two beams, such as above described, supporting a floor upon and between them. *g*, is an arch of corrugated iron, sustaining, by means of the bearers *h*, the horizontal plates *i*, of corrugated or plain iron, which lie upon the beams *m*; and on these plates cement, asphalte, concrete, or such like material, may be laid, to form the even surface of the floor. The thrust of the arch may be counteracted, in large buildings, by wrought iron tie-rods, of any convenient form, as shewn at *j*; which rods pass through the arch *g*, and are keyed up on each side of the beams with the tie-bars of the adjoining arches. To prevent fire from spreading, the patentee also fixes horizontal plates of corrugated or plain iron between the beams, at the lower part of the same, as indicated by the dotted lines *k*,—such plates may be strengthened by placing a bar of angle iron across the corrugations, and riveting it thereto; and they may be supported by rods from the arch *g*, as shewn at *l*.

The patentee also shews the application of a curved rib or beam, (constructed in the same manner as the one represented at figs. 12 and 13,) for sustaining a level floor or (in the event of its being applied to a bridge) a level road, by means of corrugated plates, placed in the spandrils of the arches.

The patentee claims, Firstly,—the application of corrugated iron, (the corrugations resisting compression in the direction of their length,) to the improving of the construction of iron girders, beams, trusses, and supports generally, as above described. Secondly,—the improved application of corrugated iron, in the manner above set forth, in order to render the floors of buildings fire-proof. Lond. Journ. Arts, Vol. 33.

Porter's Patent Corrugated Iron Beams.

Mr. Porter, of the Iron-roofing Works, at the Grove, Southwark, has recently taken out a patent for the employment of corrugated iron in the construction of beams; and for the purpose of testing the strength some experiments were made, of which the following is an account.

Two beams made on this plan were submitted to the test; the extreme length of each 22 feet, and span between the supports 20 feet 6 inches; depth of beam, 18 in.; weight of beam, 8½ cwt.; the top and bottom frames were of 4 in. × 4 in. T-iron, and the base ½ in. thick; the plates of corrugated iron forming the beam being of No. 16 gauge, and the bands 1½ in. × ½ in. thick. The two beams were placed 9 feet apart, and across these were laid two large oak blocks, weighing 1 ton 3 cwt., and supporting the further load. These blocks or bearers, (the one 19 in. and the other 24 in. wide,) were 4 ft. 3 in. apart from centre to centre, and equidistant from their centres to the centre of the beam, 25⅝ in.; upon these were laid cast iron blocks, weighing 6 tons 17 cwt. This weight was put on on Saturday and remained till Tuesday, without causing any deflexion. On

Tuesday, in the course of an hour and a half, an additional load was applied of 121 bundles of plate iron, weighing 7 tons 3 cwt. 16 lb., producing a deflexion of $\frac{9}{16}$ths of an inch.

This load was allowed to remain from 1 P. M. on Tuesday until 10 A. M. on Wednesday, in the course of which time the deflexion had increased $\frac{1}{16}$th of an inch. Fifty-one bundles of plate iron, weighing 3 tons 9 cwt. 1 qr. 2 lb., were now added, which caused a total deflexion of 1 inch bare; rested a quarter of an hour, when 32 bundles of plate iron, weighing 1 ton 18 cwt. 12 lb., were added, which increased the deflexion to $1\frac{3}{8}$ in. and $1\frac{3}{16}$ in. respectively; the difference being evidently occasioned by the settling down of the piers, giving a greater load to one beam. A further load, weighing 2 tons 8 cwt. 3 qrs., brought the deflexions to $1\frac{5}{8}$ in. and $1\frac{3}{4}$ in. This loading was proceeded with gradually during three hours, when the load was left for an hour.

In the meantime a slight noise called attention to a partial dividing of the bottom flanch of T-iron, in the beam which hitherto appeared the least strained; upon examination, it was found to have originated in a flaw near a "shut" in the T-iron, distant 6 ft. 3 in. from the point of support; this caused a further deflexion of $\frac{1}{16}$th of an inch, but the fracture did not appear to increase during half an hour. The deflexion of the beams increased to 2 in. and $1\frac{3}{4}$ in. with an additional load of 2 tons 6 cwt. 2 qr. 22 lb., applied gradually during three-quarters of an hour. After a further lapse of 10 minutes, a further load of 7 cwt. caused a rapid deflexion in the already weakened beam, the corrugated iron giving way at the same time to the strain of the rivets longitudinally. The beams were now blocked up to prevent any accident from the sudden falling of the load. The corrugated iron of the other beam, was also found to have yielded in several places to the longitudinal strain of the rivets, principally in the lower part of the beam.

The breaking weight is, therefore, considered to be about 25 tons, exclusive of the weight of the beams.

The inventor considers that his beams will not weigh more than one-half or five-eighths of the weight of cast iron beams to carry the same load, and that they may be made for £21 per ton.

Civ. Eng. & Arch. Jour., Feb. 1849.

Description of Harbor Screw Cramps, designed for temporary use in binding together the Stones in the construction of Harbor and other Marine Works. *By* Thomas Stevenson, Esq., F. R. S. E., C. E.

This paper states that the great majority of instances of damage to harbors from gales occur during construction, or from neglect in repairing, and shews the almost total dependence of a whole pier on the stability of each stone in the structure. Many instances are adduced of harbors suffering great damage during construction, which, after being "*closed in*," and completed, have withstood the assaults of after storms. The principle on which these screw cramps have been designed, is that of coupling stones together in such a manner that the outermost cannot be removed without dragging the adjoining stones along with it. The first of these

implements is adapted for a vertical wall, and consists of a cross-rod of iron inserted diagonally between two of the stones of the works, and on either end of this rod chains are slipped, (one set being at the front of the wall, and the other at the back.) These pass through openings in an abutment-plate placed diagonally across the last stone, and are tightened up by means of capstan-headed screws.

The second of these implements is designed more particularly for a talus, or sloping wall, and consists of a kneed abutment-plate, (placed upon the last or outermost stone of the unfinished work,) connected by chains to a ring-bolt, fixed in any stone at a sufficient distance from the open end of the work, or even to a crow-bar driven down between any open joint in the masonry. These chains are tightened up by means of a draw screw. This apparatus, in the event of a storm coming on suddenly, could be applied in the course of a few minutes.—*Proc. Roy. Scot. Soc. of Arts.*

Ibid.

Wrought Iron Cofferdam.

Last month the experiments undertaken by Mr. Brunel, at the instance of the Admiralty, for carrying the railway bridge across at Saltash, for the Cornwall Railway, were brought to a successful close. For the purpose two old gun-brigs, purchased of the government, were moored over the spot, and a wrought iron cylinder, of $\frac{3}{8}$ inch boiler plates, strongly riveted together, 85 feet high, and 6 feet diameter, and of 28 tons weight, was sunk *in profundis*. The necessary apparatus for pumping out the water was then applied, and the experimenters, who afterwards descended to the bottom of the cylinder, had the satisfaction of finding that, at 11 or 12 feet below the mud, there was a foundation of solid rock for the piers.—The bridge will be of large dimensions, the Admiralty requiring that it shall have a clear width of 300 feet between the piers, and a clear height of 180 feet above high water mark. Over it will pass the entire passenger traffic from Plymouth to the Land's End. Ibid.

Suspension Bridge at Pesth.

The Pesth Suspension Bridge, which is erected over the Danube at Pesth, was commenced in 1840, according to the designs and under the direction of William Tierney Clark, civil engineer, and has just been completed at a cost of £650,000. This bridge, which, for magnitude of design and beauty of proportions, stands first among suspension bridges, has a clear water-way of 1250 feet, the centre span or opening being 670 feet. The height of the suspension towers from the foundation is 200 feet, being founded in 50 feet of water. The sectional area of the suspending chains is 520 square inches of wrought iron, and the total weight of the same, 1300 tons. This is the first permanent bridge, since the time of the Romans, which has been erected over the Danube below Vienna, it having been considered impossible to fix the foundations in so rapid a river, subject to such extensive floods, and exposed to the enormous force

of the ice in the winter season. It now, however, stands as another monument of the skill and perseverance of our countrymen.

The bridge was opened for the first time, not to an ordinary public, but to a retreating army, on the 5th of January, 1849, by which the stability of the structure was put to the most severe test, which cannot be better described than by referring to the letter of a correspondent, who writes—"First came the Hungarians in full retreat, and in the greatest disorder, hotly pursued by the victorious imperialists; squadrons of cavalry and artillery in full gallop, backed by thousands of infantry—in fact, the whole platform was one mass of moving soldiers; and during the first two days, 60,000 Imperial troops, with 270 pieces of cannon, passed over the bridge."

This fact cannot but be of importance to the scientific world, since it proves that suspension bridges, when properly constructed, and trussed according to the design of Mr. Clark, may be erected in the most exposed places, while their cost, in comparison with stone bridges, is insignificant.

Ibid.

AMERICAN PATENTS.

List of American Patents which issued in the month of May, 1848, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in Spark Arresters;* Andrew M'Cleary, Philadelphia, Pennsylvania, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of arranging the double series of oblique plates or flanches, which are made to cross each other, between the perforated cylinder and the external case, within the head or cap, in the manner and for the purpose set forth."

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2. For an *Improvement in Rivet Machines;* William Van Anden, City of New York, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the adjustable eccentric or cam, for the purpose of increasing or decreasing the throw of the same, by means of a centre that may be varied, and this in combination with the header, so as to make rivets with large or small heads, by such variations of throw of the eccentric.

"2d, I claim the method of assorting the headed rivets from the unheaded pieces of metal, by means of an inclined trough and vibrating apron, constructed and operating in the manner set forth."

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3. For an *Improvement in Preparing Gutta Percha Fabrics in imitation of Leather;* H. H. Day, Jersey City, Hudson county, New Jersey, May 2.

The patentee says,—"My invention consists in the forming of flexible fabrics with a bright gloss, adapted to all the various purposes for which patent leather, japanned cloth, and other similar manufactures have been hereto-

fore used, and free from the liability to crack peculiar to most fabrics of this nature, and at about half the cost. The first part of my invention consists in coating the surface of gutta percha in sheet, and fabrics made entirely of gutta percha, with varnish, whereby I give it a lustre and finish resembling japanned leather and other similar substances. The second part of my invention is the combining cloth, canvass, felting, leather, and other fibrous materials, with gutta percha and varnish, for the production of fabrics adapted to dash boards and other purposes for which heavy japanned leather has heretofore been used."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the finishing or treating of cloth or other articles, made wholly or partly of gutta percha, and cloth or fabrics made of these, with japanned varnish, such as is generally used in the manufacture of patent leather, as set forth."

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4. For an *Improvement in Smiths' Bellows;* Morgan Loomis, Worcester, Otsego county, New York, May 2.

The patentee says,—"The nature of my invention consists in providing the upper part of the bellows, or wind chest, with two perpendicular bellows, or self-filling reservoirs, one on each side of the said wind chest, and forming the sides of the same, the outside plank or part being attached to the end of a leather strap passing over pullies immediately above the wind chest, and secured at its opposite end to a vertical standard connected to a weight fastened to the top of the wind chest, in such a manner that the pressure of the wind from the lower bellows will fill the wind chest, and raise the weight and slacken the straps, and allow the outside or movable part of the upright bellows to open outward by their own gravity, causing said bellows to become filled with air; and when the pressure of wind from the bottom bellows is stopped, the weight in its descent closes the outer valves of the self-filling reservoirs, and presses the wind out of the same into the wind chest, and forces it through four or more wind or faucet pipes arranged on each side, and communicating with the fires to be operated upon;—each of the before mentioned reservoirs or bellows being provided with suitable swinging valves, for regulating the ingress and egress of the wind."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is combining with the double bellows and air chamber, the two side bellows, arranged and operating in the manner and for the purpose described."

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5. For an *Improvement in Separating Gold;* Isaac Babbitt, Boston, Suffolk county, Massachusetts, May 2.

The patentee says,—"The nature of my invention consists in the causing of the gold or silver which is to be separated from the ore, or from other foreign or extraneous matter with which it is mixed or combined, to form an alloy with lead, instead of amalgamating these metals by means of mercury, as has heretofore been practiced; and this I effect by taking the ore of the metal, duly pulverized and washed, or pulverized only, as may be found most convenient, in which I govern myself according to the nature

of the ore and other attendant circumstances; or I take the sweepings or other admixtures of the precious metals, and prepare them by burning, washing, or other known means, for the more easy combination of the contained metal or metals with the lead."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the exposing of the ore or ores, or combination or admixture of the precious metals with foreign materials, together with metallic lead, and charcoal, sal ammoniac, or other flux, in closed vessels, in which the whole may be subjected to red-heat, for the purpose of causing the precious metal or metals to combine with the metallic lead, instead of amalgamating the same with mercury, for the purpose and substantially in the manner set forth, without intending to confine myself to any particular mode of constructing the apparatus used, but to vary this as I may think proper, whilst the principle of operation remains the same. In the apparatus, I claim, in combination with the vessel containing the molten lead, and provided with an aperture for the discharge of the impurities, and another for the discharge of the lead, the rotating plate, provided with the hollow arber for the supply of the ore, &c., and with the teeth for carrying the ore towards the periphery, substantially as set forth. And finally, I claim the method, substantially as herein set forth, of charging the apparatus with the ore, &c., without admitting air, in combination with the method of carrying the ore, &c., through the apparatus, and over the surface of the lead in the vessel, as described."

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6. For an *Improvement in Locomotive Steam Boilers;* Elisha Ayer, Norwich, New London county, Connecticut, May 2.

Claim.—"What I claim as new, and desire to secure by letters patent, is the locating the radiating chamber in the end of the boiler opposite the furnace, and connecting the same with the chimney by means of the flue spaces, between the external casing of the boiler and the enclosing casing, substantially in the manner and for the purpose set forth. I also claim the manner of heating the air for combustion, previous to its entering the furnace, by means of the space between the flue casing and the external casing, (enclosing the same,) connected to the space between the double casings of the chimney, and with the furnace by means of the tube, substantially as set forth. I also claim the enclosing of the safety valve with a cap, and connecting the same with the water reservoir for supplying the boiler, by means of a suitable pipe, for the purpose herein specified."

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7. For an *Improvement in Ships' Anchors;* W. A. Kentish, City of New York, May 2.

The patentee says,—"The nature of my invention consists in the adaptation of a stock, (as I believe it is termed,) very different from the one hitherto used, in its formation, which tends materially to increase the resistance of the common anchor, when employed for the purpose of security.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a bent or semi-circular stock, or a straight or semi-quadrangular stock, to an anchor turning on its centre, and having a

fluke at each extremity, which movable stock may be made of iron, or any other metal, or of any convenient material."

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8. For an *Improvement in Corn Shellers;* J. N. Warrington, Damascoville, Mahoning county, Ohio, May 2.

The patentee says,—"The nature of my invention consists in a new construction of a cast iron bed-plate, for containing a series of newly constructed self-adjusting cast iron strippers, for stripping the corn from the cob, having an opening in the centre for the escape of the cob, and a series of inclined planes for conducting the shelled corn to an inclined screen affixed to a bench—the bed-plate being covered by a dome-shaped curb, for preventing the grain escaping above."

Claim.—"What I claim, as my invention, and desire to secure by letters patent, is the combination of the passages for the shelled corn, inclined screen, and the tube for the cobs, as set forth."

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9. For an *Improvement in Sash Fasteners;* T. W. H. Moseley, Columbus, Franklin county, Ohio, May 2.

The patentee says,—"The nature of my invention consists in having a peculiar heavy end to a lock, to hold up-and-down sashes in a window. This peculiarity in a lock for this purpose, generally prevents it from turning over when the window sash is hoisted or lowered; and, in addition to this, that the lock may, without fail, keep its position while the sash is in motion, I have introduced a spring, which is attached to the lock and operates with it."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is having two eccentric sides similar to each other, the one preponderating over the other, and hung upon a pin, so that in one position, the sash will be held up by the pressure of one side of the fastener against the casing of the window, and in the reverse position, it will be held down by a similar pressure of the other side of the fastener, the preponderating side causing the fastener to be constantly against the casing of the window; and in combination therewith, I claim the spring and stops, for preventing the fastener from being accidentally reversed; the whole being constructed and operating substantially as set forth."

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10. For an *Improvement in Hot Air Furnaces;* Gardiner Clinton, Boston, Massachusetts, May 2.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the inclined pipe in the centre of the bottom of the dome, for carrying the products of combustion down, in combination with the vertical flues surrounding the same, and forming the communication between the fire chamber and the drum or dome-formed chamber, as described, whereby the currents of products of combustion are reverberated, to give an equal, or nearly equal, heat to the whole surface, and at the same time giving a free discharge to the soot, dust, ashes, &c."

11. For an *Improvement in Brick Kilns;* Joseph Ogle, Baltimore, Maryland, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The interposition of a grating of fire-brick, between the fire and the brick to be burnt, in the manner described, by means of which I prevent the fire in the arches from immediate contact with the brick to be burnt, thereby obviating the danger of the bricks adhering together in the lower portion of the kiln, and blocking up the channels formed in the setting of the brick, for the circulation of the heat.

2d, The construction of a grating along the floor of the kiln of fire brick, or other suitable material, in the manner specified, and combining the same with the grating and draught holes in the roof, by means of which I cause the greater part of the heat emanating from the arches to circulate between the floor of the kiln and the grating, and thence upward to every part of the kiln, thus enabling the operator to burn the brick to any degree of hardness requisite."

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12. For an *Improvement in Steam and Vacuum Gauges;* Paul Stillman, City of New York, May 9.*

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, Combining with the reservoir of mercury, at the lower end of the gauge tube or tubes, an elevated bulb or chamber, to form part of the reservoir, substantially as described, that the level of the mercury in the tube may at all times be sufficiently high in the tube to be visible.

"2d, I claim making the bulb or reservoir of such capacity, in combination with the partial exhaustion of the tube of the steam gauge at the time of charging the instrument, as that the tension of the air above the mercury in the tube, when a partial vacuum is produced in the boiler, shall not be sufficient to force all the mercury out of the tube, as described, whereby the quantity of air in the tube shall be always the same.

"3d, I claim surrounding the lower edge of the glass tube with a metallic gland or tube, provided with a cap at bottom, through which the mercury can pass slowly, to establish the connexion with the reservoir, substantially as set forth.

"4th, I claim the method of preventing the passage of moisture from the surface of the mercury in the reservoir, between the mercury and the metallic gland, by tinning the outer surface of the gland, that the mercury may adhere thereto sufficiently to effect the purpose desired.

"And lastly, I claim preventing the glass tube of the steam gauge from being soiled by the oxydation of the mercury within it, by introducing within the tube, and on the surface of the mercury therein, naphtha, or any other fluid which will prevent the oxydation of mercury, substantially as described, and thus preserve the glass tube in a clear and transparent state, as set forth."

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13. For an *Improvement in Cane Umbrellas;* Isaac Hammond, Philadelphia, Pennsylvania, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters

* See page 207.

patent, is the connecting of the rod with the socket-piece, and with the cap, by means of spring catches, which are received within grooves that extend around the interior of the said socket-piece and cap, in the manner and for the purpose set forth."

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14. For an *Improvement in the Formation of Dies;* Lyman W. Coe, assignee of Thomas Hollister, Cornwall, New Haven county, Connecticut, May 9.

The patentee says,—"The nature of my invention consists in constructing the force, punch, or follower of the die, of separate pieces or transverse sections, which can be attached together at pleasure, and used as a whole or in part, as the work may require, and which, when all united together, will correspond in shape with the article to be raised."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a force, punch, or follower of a die for stamping up or raising up hollow ware from sheets or plates, in separate pieces or transverse sections, which can be attached together at pleasure, and used as a whole or in part, as the work may require, and attaching them together and to the drop or hammer, by means of a bolt or any other method that may be found convenient."

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15. For an *Improvement in Utero-Vaginal Bathers;* C. Brailly, City of New York, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the constructive combination of the stock, pad, tubes, and stop-cock, and cork or stop-cock, as described."

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16. For an *Improvement in Pessaries;* L. A. Gescheidt, City of New York, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of an elastic ring or oval with an air tight bag, substantially as set forth.

"2d, The combination of an elastic ring or oval with an air bag and a second bag, to admit the application of the injection, substantially as set forth."

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17. For an *Improvement in Locks;* William Reynolds, Nichols' Mills, Greenbriar county, Virginia, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the inside works of the lock, as described, so that it cannot be unlocked by its own key, or any other lock-pick whatever, and can only be unlocked at the extreme end of the wire or cord."

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18. For an *Improvement in Railroads;* J. E. Smith, City of New York, May 9.

The patentee says,—"The nature of my invention consists in avoiding, in a great measure, the want of elasticity, and consists in interposing india

rubber, or other elastic material, between the iron rails and the beds on which they rest, and to which they are attached, to act as elastic cushions and ease off the sudden shocks or jars of locomotives and other cars when passing over the rails."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method, substantially as set forth, of giving elasticity to the rails of railroad tracks, by interposing between the iron rails and the stringers, cross-ties, sills, or chairs, strips or sheets of india rubber, or other like or similar elastic substance or substances, as set forth, whereby much of the injury now sustained by the tracks of railroads, and the locomotive and other cars, produced by the shocks and jars consequent on the rapid transits of trains, is avoided or modified."

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19. For an *Improvement in Weather Strips for Doors;* Z. R. Moody, Bridgeport, Fairfield county, Connecticut, May 9.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the strip to the sill of the door, including also the sliding catch and spring stop."

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20. For an *Improvement in Atmospheric Churns;* Nathan Chapen, Cortlandville, Cortland county, New York, May 9.

The patentee says,—"The nature of my invention consists in arranging within a suitable box or case in which the cream is placed, two or more buckets secured to horizontal journals, and revolving with the same, in such a manner in relation to the surface of the cream, as to alternately carry, at each revolution, a body of air with them below its surface, and to release the same near the bottom of the case, and allow it to ascend in bubbles through the cream, to the space above the same, and to convey a quantity of cream above said surface, and discharge it from the buckets into the space above, near the top of the case, thus causing the fatty substance of the cream to be brought into contact with the oxygen of the atmosphere, and speedily formed into butter."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is forming the paddles of the revolving wheels with buckets of the peculiar shape described, for the purpose of raising the cream nearly to the top of the churn, and discharging it through the air therein admitted through the aperture in the lid, as well as breaking up the cream by the revolving of the buckets through the cream, by which the butter is produced in a very short period of time; said buckets conveying the air to near the bottom of the churn, and discharging it through and amongst the cream, by which the oxygen of the air is brought into close contact with the fatty substances of the cream, and by which they are caused to incorporate readily into a solid mass in the form of butter, as set forth."

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21. For an *Improvement in Churns;* Willis H. Johnson and Thos. Lewis, Springfield, Sangamon county, Illinois, May 9.

The inventors say,—"The nature of our invention and improvement

consists in a new combination and arrangement of known mechanical devices, whereby cream is churned by mixing a stream of atmospheric air with it, at the same time that it is subjected to agitation by a revolving dasher in the usual way."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the process of making butter by the combined action of the hollow rotary shaft and radial arms, the arms agitating the cream and diffusing the air through the same, substantially in the manner set forth."

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22. For an *Improvement in Cleaning Wool and Cotton;* Addison Arnold, Walpole, Norfolk county, Maasachusetts, May 9.

The patentee says,—"My improvement consists of wire set in leather, or other elastic substance, of much smaller size and more than twenty times as thick as they can be used when set permanent; and for protection to these, I claim the invention of the guard bars, which must break down any hard substance, and come up to the proper place."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the substitution of clothing of wire set in elastic substance, in the place of permanent teeth, in combination with bars of iron and steel, to protect the clothing substantially as set forth."

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23. For an *Improvement in Machinery for Making Bullets;* J. Drummond, City of New York, May 9.

The patentee says,—"The nature of the first part of my invention consists in making bullets from flat plates of lead, cast, rolled, hammered, or otherwise formed, of a thickness less, and of a width greater, than the intended diameter of the bullets to be formed, when this is to be combined with the process of making such bullets, by cutting the lead for each bullet, by a punch and die, from the width of the bar, by means of which combined process or mode of procedure, the bullets are cut off and formed without leaving scraps of lead in the operation of cutting, as heretofore, thus saving the labor required in recasting the scraps, and forming them into a bar. And the second part of my invention relates to the machine for cutting off the pieces from the bar and forming the bullets, and consists in using a punch, the end of which is formed with a semi-spherical cavity, combined with a die having a cylindrical cavity for the punch to move in, the bottom of which is in the form of a semi-spherical cavity, with a small hole in the centre thereof, to which in adapted a sliding follower, one end of which constitutes a portion of the semi-spherical cavity of the die, the said follower being so connected with the punch, that when it (the punch) is drawn back, it shall carry the follower with it sufficiently far to discharge the formed bullets, and then permit the punch to move back, independently of the follower, to leave the required distance between them to receive the bar of lead, which is of greater width than the diameter of the bullet when formed."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method set forth of forming bullets, by cutting at each operation a piece across the width of a bar of lead made thinner and wider than

the diameter of the intended bullet, that the punch, in the operation of cutting, may force the said piece of lead into the die, and there swage it into the required form, and thus avoid leaving remnants, as described."

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24. For an *Improvement in Shingle Machines;* Sterling Brewer, Robertson county, Tennessee, May 16.

Claim.—"What I claim is on the application of the second or bottom knife, and the adaptation of the machine as represented by the parts, or lever and rest attached, or bevelled notch, or movable floor, or hollow and angle in top frame, or bottom knife, to shaving both sides of the shingle, without turning the block and at a single stroke of the pitman."

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25. For an *Improvement in Shoulder Braces;* Henry F. Briggs, Poughkeepsie, Dutchess county, New York, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the brace, by combining with the shoulder strap, the straps with their loops for fastening, in the manner set forth; and in combination therewith, the elastic piece in the shoulder strap, as set forth."

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26. For an *Improvement in Weather Strips for Doors;* W. Ottiwell and J. C. Kent, New Bedford, Bristol county, Massachusetts, May 16.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of the auxiliary guard with the lip of the guard plate, substantially as set forth, for the purpose of closing up the opening to the space above the guard plate, thereby preventing snow or ice from accumulating on the same, that would obstruct its movements and speedily cause its destruction."

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27. For an *Improvement in Churns;* Stephen Ballard, Meigs' Creek, Morgan county, Ohio, May 16.

The patentee says,—"The nature of my invention consists in combining an air pump with the reciprocating dasher of the common upright tub or barrel churn, for the purpose of churning cream, by forcing a current of air through it at the same time that it is agitated by the dasher."

Claim.—"What I claim as new, and desire to secure by letters patent, is the combination of the reciprocating annular dasher and air pump with the tub or barrel to contain the cream, the same being constructed, arranged, and operated substantially as set forth."

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28. For an *Improvement in Electric Telegraphs;* C. F. Johnson, Owego, Tioga county, New York, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The forming signs for telegraphic purposes, by the dropping of balls upon an endless belt moving with an uniform velocity, substantially in the manner described.

"2d, I claim the taking off impressions on paper, from balls as dropped, substantially in the manner described."

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29. For an *Improvement in Corn Shellers;* A. H. Stevens, Geneva, New York, May 16.

The patentee says,—"The nature of my invention consists in so arranging the teeth on the face of the revolving disk, as that the cob shall be carried round as far as is found necessary, and then discharged, while the corn is all conveyed down through a blast and is winnowed from the chaff, which is blown away."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the teeth on the disk in radial lines, in combination with teeth near the periphery between said lines as set forth. I also claim the combination of the spouts therewith, for effectually separating the corn from the cobs after shelling, as set forth."

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30. For an *Improvement in new form of Brick;* N. Towson, City of Washington, D. C., May 16.

The patentee says,—"My invention consists in moulding brick with dove-tail grooves or indentations, that will retain, by means of the dove-tails, mortar or any plaster material used for cementing brick, or for plastering, stuccoing, or rough-casting brick work."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the forming the brick with dove-tail grooves, or other dove-tail indentations, by means of which the bricks, when covered with mortar, will be held together, and by which mortar, plaster, or other material used in plastering, stuccoing, or rough-casting brick work, will be securely fastened thereto, and prevented from cracking or falling, or peeling off."

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31. For an *Improvement in Beading Tin, &c.;* John Eppley, York, York county, Pennsylvania, May 16.

Claim.—"What I claim, and desire to secure by letters patent, is the combination of the revolving mandril and concave recess, constructed substantially in the manner set forth."

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32. For an *Improvement in Weather Strips for Doors;* E. C. Matthewson, Hartford, Connecticut, May 16.

The patentee says,—"The nature of my invention consists in making two strips of wood, the length of which is equal to the width of the door, one of said strips is beveled on two edges; one of the bevels is placed next the door on the outside and near the bottom; to the other bevel is hung, with butts, in the usual way, another narrow strip; a hole is bored horizontally into the door under the lower strip, into which a spiral spring is fastened, for the purpose of raising said strip when the door is opened, but on closing the door said strip is struck down by a small brass or iron plate secured to the jamb of the door."

Claim.—"What I claim as my invention, and desire to secure by letters patent is the construction of weather strips in two pieces, hung together with butts, and attaching the upper piece firmly with screws to the outside of the door, near the bottom, while the lower or vibrating piece will be struck down by means of the plate screwed to the jamb of the door, when the door is shut, so as to fit closely to the threshhold, and so that it will be thrown up by the spring when the door is opened, the whole constructed and arranged as set forth."

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33. For an *Improvement in Churns;* P. H. Watson, Rockford, Winnebago county, Illinois, May 16.

The patentee says,—"The nature of my invention consists in providing a series of elastic vibrating agitators, arranged upon a cross and placed in the bottom of the tub, to act in conjunction with the rotating spiral dasher, in agitating the cream for the purpose of churning it."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the elastic vibrating agitator with the rotary spiral dasher, in the manner set forth."

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34. For an *Improvement in Drying Grain;* Amos Bigelow, Adrian, Lenawee county, Michigan, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing a kiln, as described, having troughs through which the grain passes, placed one above the other, and accessible at all points where the grain passes in its course through the drying kiln, as set forth; the course of the grain being in one direction, and that of the smoke and heat in another, substantially as set forth, but in separate compartments."

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35. For an *Improvement in Producing Wood Mouldings;* A. T. Serrell, City of New York, May 16.

Claim.—"What I claim as new and as of my invention, and desire to secure by letters patent, is the application of the changeable feeding rollers, made as disks or flat rings, with serrated edges of varying angles, and changeable or unequal diameters, to feed in materials cut in varying or irregular sections, in combination with changeable rotary cutters, and changeable standing planes, to produce wood mouldings of different sizes with smooth surfaces, from materials cut or prepared in varying or unequal sections for such purposes."

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36. For an *Improvement in Dipping Candles;* John A. & Alfred F. Jones, Lexington, Fayette county, Kentucky, May 16.

Claim.—"What we claim as new, and desire to secure by letters patent, is, first, the constructing the candle rods in two pieces, and the manner of supplying them with candle wicks, as set forth. We also claim the use of the large vertical rotating reel, combined with the series of small rotating reels suspended at the extremities of its arms, and with the swinging

frames that receive the candle rods, suspended from the extremities of the arms of the small reels, arranged and operating as set forth.

"We also claim the combination of the tallow box and dripping board with the large rotating reel, the series of small reels, and swinging frames, suspending the candle rods, as set forth. We also claim the connecting the tallow box to the platform or base of the machine, by means of hinges at its sides and ends, for the purpose of preserving the box in the undeviating horizontal position whilst it is being raised and lowered."

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37. For an *Improvement in Facing and Dressing Mill Stones;* John Kinman, Mifflinburg, Union county, Pennsylvania, May 16.

The patentee says,—"The nature of my invention consists in certain new and useful combinations, arrangement, and operation of mechanical devices, by which the inclined sides of the angular furrows are cut of the required inclination, form, and depth, by a pick secured to the end of a vibratory lever, operated in the manner of a trip hammer, whose fulcrum is in a block, is moved at right angles to the furrow while the pick is in operation, and is placed in a carriage which is made to move longitudinally and parallel with the line of the furrows while they are being cut."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining a bellows with the vibrating pick, and operating them substantially by the same revolving tappet or cam wheel, in the manner set forth."

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38. For an *Improvement in Shelling Corn and Separating the Dust from the same;* Benjamin Edwards, Lacyville, Wyoming county, Pennsylvania, May 16.

Claim.—"What I claim as new, and desire to secure by letters patent, is the giving the concave a flexible and self-adjusting bearing on the cylinder, by the following combination and arrangement, to wit: constructing the concave of two jointed parts, connected to the permanent rod at the front, and suspended by the flexible bands passing under the concave, with their front ends made fast to a rod and their rear ends to the springs, as set forth. I also claim the combining a screen, of the form described, with the bands and the tail board, as set forth."

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39. For an *Improvement in Regulating the Closing of Gates, Doors, &c.;* William Wilson, Northampton, Northampton county, Massachusetts, May 16.

Claim.—"What I claim as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the friction roller and the tilling or guide piece with each other, and with the adjustments, for the purpose of causing the door to fall back or to remain at rest in any position to which it may be opened beyond the point designated."

40. For an *Improvement in Hulling Clover Seed;* George Gardiner, York Springs, Adams county, Pennsylvania, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is 1st, The combination of the round teeth set in the cylinder, as set forth, with the diamond-shaped teeth in the concave, the whole being constructed in the manner and for the purpose set forth.

"2d, I claim the removable piece between the hopper and the concave, for the purpose of discharging the stones or other obstructions that would be likely to break the machine."

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41. For an *Improvement in the Plough Clevis;* Isaac Evans, Lebanon, Warren county, Ohio, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the adjusting apparatus, consisting of the movable block to which the draught ring is attached, and the bridge supporting the vertical adjusting screw, in combination with the clevis, the adjusting screws and beam, by which I am enabled to alter the position of the point of draught vertically and horizontally, with any degree of nicety, without having to weaken the beam, by a special perforation for an adjusting bolt."

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42. For an *Improvement in Fire Proof Safes;* Jesse Fitzgerald, City of New York, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the pipe, (leading from a head of water,) with its arrangement of stop-cock, lever, and string, with the space all round the inner casing of the safe. I also claim the combination of the hole in the top of the door opening, and the corresponding one in the door, with the hollow space in the door, for the purpose of rendering the door fire proof, in the manner described."

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43. For an *Improvement in the Mode of Removing Horses or Cattle from a Stable when on Fire;* Emery N. Moore, Boston, Massachusetts, May 16.

Claim.—"What I claim as my invention, is the combination of the chain, locking bar, (having studs,) and the movable bars, or their mechanical equivalents, the whole being arranged and made to operate together substantially in the manner and for the purpose set forth."

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44. For an *Improvement in Watering the Tracks of Railroads;* W. Ross and W. E. Rutter, Providence, Rhode Island, May 16.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the combination of a sprinkling or watering apparatus with the tank of a tender or locomotive engine and train of a railway. We also claim the manner in which we arrange, combine, or apply a water discharging apparatus to a train of railway cars, viz: in advance of the cars and wheels drawn by the engine or drawing power, whereby the rails and

road bed are wet, for the purpose of diminishing friction of the working parts and keeping down the dust, as specified, while the train is in motion on the track."

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45. For an *Improvement in the Barrel Churn;* Edward Spain, Philadelphia, Pennsylvania, May 16.

The patentee says,—"The nature of my invention consists in giving such a peculiar formation to the exterior surface of the dasher, that it can be placed whole within the churn, or removed from the same, through a square aperture in the side, near one end of the churn; the peculiar form of the dasher also imparting, as it is operated, a compound reciprocating and rotary motion to the cream, thereby more thoroughly and effectually agitating the same, and preventing the cream, when it becomes thick, from revolving with the dasher."

Claim.—"What I claim, is the giving the dasher the form set forth, which, while it imparts reciprocating and rotating motion to the cream, as it is operated upon thereby, also enables a large sized dasher to be passed whole through a comparatively small sized square aperture in the side of the barrel, as set forth."

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46. For an *Improvement in the Manufacture of Brick;* Alfred Sabbaton, Reading, Berks county, Pennsylvania, May 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, Reducing the clay by the action of two rollers, grooved in the direction of their peripheries, and mashing or running in each other, as described, the periphery of one of the rollers being made to move with greater velocity than the other, as described.

"2d, I claim pulverizing the clay, by passing it between the faces of two disks turning on different axes, and armed with teeth, substantially as described, the clay being acted upon and pulverized by the peculiar motion of the teeth on the two disks, gradually approaching one another until they reach a plane passing through the axes of the two disks, and then gradually receding, as described.

"3d, I claim making the faces of these disks, in this combination and for this purpose, conical, substantially as described, whereby the action on the clay is improved, as described.

"And lastly, in the machine for moulding and pressing bricks, I claim giving to the moulds, during the operation of pressing, a motion in the direction of the motion of the followers, substantially as described, whereby the bricks are pressed equally and made of equal density on both faces, to prevent warping when being baked."

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47. For an *Improvement in Horse Rakes;* M. W. Baldwin and A. S. Lyman, Philadelphia, Pennsylvania, May 16.

The patentees say,—"The nature of our invention consists in raking the hay by means of two rakes, attached each to the forward part of an appropriate frame, jointed to the forward part of a hay cart or wagon, one frame being shorter than the other, that the rake which it carries may clear and

work within the other, so that as soon as one is filled it shall be elevated to deposit the hay in the wagon, the other in the meantime receiving the charge, and vice versa, the rakes being operated during the forward movement of the wagon, by means of ropes operated by the attendant, or by the rotation of the wagon wheels."

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the method, substantially as herein described, of raking and elevating hay, and delivering it into a wagon or other receptacle, by means of the rake frames, so jointed or otherwise connected with the wagon as to admit of being elevated, to raise and discharge the hay into the hay box of the wagon, or any other receptacle, as described."

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48. For an *Improvement in Threshing Machines;* Edmund Warren, City of New York, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application to a threshing cylinder of the metallic spring plates, in the manner and for the purpose set forth."

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49. For an *Improvement in Making Flexible Syringe Tubes, &c., of Gutta Percha;* Henry Bewley, Dublin, Ireland, May 23.

Claim.—"What I claim, is the application of gutta percha, in any of the states, and by any of the processes, before specified, to the manufacture of flexible syringes, tubes, bottles, hose, or other like vehicles or vessels, or to the improvement of such articles after manufacture, as aforesaid."

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50. For an *Improvement in Making Bands or Belts of Gutta Percha;* Chas. Hancock, Grosvenor Square, Middlesex county, England, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of making bands and belts of gutta percha, or the compounds thereof, by the process of forming, in combination with the process of stretching or drawing out, substantially as set forth; and this I claim, irrespective of the methods that may be employed for forming, or stretching, or drawing out the bands or belts."

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51. For an *Improvement in Making Articles of Gutta Percha, by Moulding, Stamping, or Embossing;* Richard A. Brooman, London, England, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manufacture of the various articles enumerated, and all others of a similar or like nature, by moulding, stamping, or embossing, to give to such articles the form required to be retained, whether useful or ornamental, whereby I am enabled to produce articles useful or ornamental, or both, at less cost, more durable, more easily applied, and in short, more valuable, than when made of any other known substance; and this I claim, whether made of gutta percha alone, or in combination with such other substances as are herein specified."

52. For an *Improvement in Making Boots, Shoes, &c., of Gutta Percha combined with other fabrics;* Charles Keene, Sussex Place, England, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making boots, shoes, and other articles of any known kind of cloth or leather, lined or coated with gutta percha, in any of its states of preparation or combination, by cementing, instead of sewing or stitching them together, as described."

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53. For an *Improvement in Pumps for Raising Water;* A. H. Fitch, Cuylerville, Livingston county, New York, May 23.

Claim.—"What I claim as my invention, is the mode of arranging and combining the bent tubes, valve seats, and cylinder, the said bent tubes being made in the peculiar manner described and represented."

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54. For an *Improvement in Threshing Machines;* Jacob Haertter, Pottsville, Schuylkill county, Pennsylvania, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the wheels or rollers, frames, boxes, rods, and arms, operating in the manner and for the purpose set forth, each of said wheels having a rotary as well as a vertical motion, and all of them turning in concentric circles."

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55. For an *Improvement in Grain Separators;* William Wilmington, South Bend, St. Joseph county, Indiana, May 23.

The patentee says,—"The nature of my invention consists in so applying a current of air, in unison with a cylinder rake, and a revolving apron, as to completely effect the separation required."

Claim.—"What I claim as my invention and desire to secure by letters patent, is taking the wind from the fan wheel between the guides on to the slide, conducting it along the under side of the apron to the curve in the upper end of the slide, following the curve around the pulley, and discharging it directly between the cylinder and the pulley, upon the side of the apron."

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56. For an *Improvement in Fastening Mail Bags;* Alonzo D. Perry, City of New York, May 23.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of a flexible sliding metallic strap, (constructed in the manner herein described,) with the flap or mouth piece of the bag, in such a way that when the flap is shut over the mouth of the bag, it may, by means of such strap, be readily secured to the body of the same, as set forth."

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57. For an *Improvement in Presses;* M. D. Cheek, Memphis, Shelby county, Tennessee, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the plane and convex cogged blocks with the levers, to form a rolling toggle joint, as set forth."

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58. For an *Improvement in the Manufacture of Spoons;* Wm. Mix, Prospect, New Haven county, Connecticut, May 23.

The patentee says,—"The nature of my invention is to strengthen the handle by a larger wire than has been heretofore used, to enclose it wholly out of sight, and to consolidate the metal around it;—this I effect by force of a die and drops, which gives also a smooth surface for finishing."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the method of strengthening the handles of spoons by wire, by casting the handles hollow by means of a draw-tap, and placing the wire therein, and by means of a drop with suitable dies, condensing and closing the metal around the wire with a smooth surface for the last finish, in the manner set forth."

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59. For an *Improvement in Clover Hullers;* James Birdsell, Hamorton, Chester county, Pennsylvania, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of the adjustive hinged concave and rotating roughened hulling wheel, in the manner set forth.

"2d, I claim the combination and arrangement of the screw rods or stops, springs, and keys, for adjusting the concave in relation to the wheel, as set forth.

"3d, I claim the manner of combining the hopper and spout, and spring, with the tangential portion of the concave and pins, for giving a shaking motion to the hopper and spout, as set forth."

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60. For an *Improvement in Threshing Machines;* Jehial Butts, Charleston, South Carolina, May 23.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the short ribs on the inner sides of the end of the case, as combined with the alternate ribs of the concave; the first-named ribs being on lines radiating from the centres of the heads, and the latter on lines running parallel with the shaft."

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61. For an *Improvement in Ice Cream Freezers;* A. H. Reip, assignee of W. G. Young, Baltimore, Maryland, May 30.

The patentee says,—"I construct the freezer with the cover firmly attached, so as not to turn on it, and from the centre of the top I project upwards a square boss, on to which, when the cover of the tub is on, I put a key through a hole in said cover of the tub, by which the freezer is turned. This key is weighted at each end of the cross-handle, which is made of cast iron, so as to act as a fly to facilitate the turning of the freezer, which acts on a cross-bar in the tub."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the combination of the revolving freezer and beater, constructed and operating as set forth."

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62. For an *Improvement in Sieves for Sanding Paper;* James P. Gage, City of New York, May 30.

The patentee says,—The nature of my invention consists in the construction of machinery for applying or affixing to the surface of paper, and like material, rough or angular grains of sand, ground glass, &c., and securing the same in a permanent manner, which, when done, constitutes the article known as sand paper. This invention consists in making sand paper in single sheets, and is performed on a peculiarly constructed table. This table consists of dial boards, and is oblong in shape; at one end there is a shallow box, the fore part of which is scarfed down to about half its depth; near the upper edge of the box a cleat is nailed, the object of which is to support the sieve."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of bracing the sieve internally, by means of the brace, as described."

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63. For an *Improvement in Winnowing Machines;* David Warren, Gettysburgh, Adams county, Pennsylvania, May 30.

The patentee says,—"The nature of my invention consists in the peculiar connexion and arrangement of the fans, as operated with the screens, propelling gear, &c., the whole constituting a new machine in its combination."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the combination of the two vertical vibratory fans with the shoe containing the screens, and with the case, the fans being vibrated simultaneously is opposite directions, in the manner set forth."

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64. For an *Improvement in Cooking Stoves;* William Gallup, Mount Vernon, Knox county, Ohio, May 30.

The patentee says,—"The nature of my improvement consists in so constructing the fire chamber separate from the rest of the stove, that it can be easily moved from the front to the back part of the stove, for the purpose of directing the heat more forcibly around the lower over, when it is required in that part of the stove. Second, In so arranging an extra oven by means of movable plates, which, when the fire chamber is placed in front, are fitted to their respective places, and thus they form an additional oven perfectly tight, which can be used when a large amount of cooking is required, and removed again at pleasure."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The manner of constructing the fire chamber, as set forth, so that it can be made to occupy a position in front, or at the back part of the stove, as may be required. And 2d, I claim, in combination therewith, forming an extra oven of movable plates, which can be removed at pleasure, the whole being combined and arranged as set forth."

65. For an *Improvement in Brick Machines;* James T. D. Wilson, assignee of Robert Wilson, Houston, Harris county, Texas, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the perpendicular feeding gauge with the pounder, in the manner set forth, and in combination therewith, the horizontal gauge working in the bottom of the hopper. I also claim the arrangement of the cam and levers, for operating the plungers, as set forth; and in combination therewith, the arrangement of the cam which operates the mould plate."

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66. For an *Improvement in Door Latches;* Edmund Morris, Burlington, Burlington county, New Jersey, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the construction of a strap, for the purpose of confining the latch to the door, containing a slot, so as to admit of a pin or other similar device inserted in the latch, to work up and down in the said slot, and having a hasp attached to its lower end by a joint, to throw up over a pin in the latch, for the purpose of holding the latch down in the catch. I also claim the pin in the latch, in combination with the strap and hasp, as aforesaid, or any other analogous device for accomplishing the same object. I do not claim the latch, as that is a well-known thing; nor a simple strap to confine the latch, without slot or hasp, as that also is well known."

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67. For an *Improvement in Winnowing Machines;* G. R. Remington, Lower Sandusky, Sandusky county, Ohio, May 30.

Claim.—"What I claim as my invention, is the arrangement of the swell or air divider with the damper, for the purpose specified or made known, or in any other way the same in principle."

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68. For an *Improvement in the Hinges for Doors, &c.;* Chas. H. Robison, Syracuse, Onondaga county, New York, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the adjustable curved inclined plane with one portion of the hinge, and the adjustable bearing roller with the other portion thereof, arranged and operating with each other substantially as set forth."

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69. For an *Improvement in Tool Sockets;* Dexter H. Chamberlain, Boston, Massachusetts, May 30.

The patentee says,—"The distinguishing features of my improvement are, that the split-shaft, in the end of which the awl or other tool is inserted and clamped, does not turn, and the nut which causes the two parts of the said shaft to be pressed together, is imbedded in, and forms a part of, the cap of the tool receptacle, in lieu of working on the end of the ferule; and by these improvements the article is simplified and made more substantial, superseding the use of a separate wrench, which is commonly used for unscrewing the nut on the end of the ferule."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, in a tool handle or awl heft, working the split-shaft by means of a nut fitted in the cap or turning part of the heft or handle, as set forth, and preventing said split-shaft from turning round, by a pin on the same, fitting into a slot on the ferule or socket, as specified."

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70. For an *Improvement in Striking or Moulding Brick;* J. W. Ward, Cambridge, Middlesex county, Massachusetts, May 30.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination with each of the vents of a water tube or fountain, so arranged as to cause water to pass over and wet the vent or passage of the clay from the hopper into the mould, as set forth."

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71. For an *Improvement in Canal Sluice Gates;* Sands C. Carpenter and William A. Peters, Clifton Park, Saratoga county, New York, May 30.

Claim.—"What we claim as new, and desire to secure by letters patent, is the manner in which we have combined and arranged such gates: that is to say, we claim the placing of two quadrant segments of a hollow cylinder with their convex sides in reverse directions, said segments being arranged and operating as set forth."

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72. For an *Improvement in the Machine for Operating, Working, or Manipulating Morse's Electro Magnetic Telegraph;* Edward R. Roe, Shawneetown, Gallatin county, Illinois, May 30.

The patentee says,—"My invention consists, 1st, of movable metallic types, as conductors of electricity or galvanism; 2d, a metallic type bed upon which they are to rest, (which is also movable to and fro, somewhat in the manner of a common printing press;) and 3d, a movable board, which is also a conductor, and is made to traverse the face of the types, thereby making, continuing, or breaking the galvanic circuit, according to the forms of the types."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of the body, the socket, the spiral spring, and the wand, with its conducting point and its non-conducting inclined planes, the whole constituting the traverser.

"2d, I claim the manner of giving the proper motion to the traverser, by the combination and action of the traverse wheel, the pulley, and the cord which plays in it, the teeth upon the traverse wheel, and the brakes operated by the type bed, in the manner set forth.

"3d, I claim the combination, for telegraphic purposes, of the types, arranged in the manner described, with the traverse, and its wand, and its conducting point, guarded by non-conducting inclined planes."

List of American Patents which issued in the month of June, 1848, *with Exemplifications by* CHARLES M. KELLER, *late Chief Examiner of Patents, in the U. S. Patent Office.*

1. For an *Improvement in Cutting Wooden Bungs or Corks for Barrels, &c.;* Joseph P. Gaume, Cincinnati, Hamilton county, Ohio, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the arrangement of the chucks, (provided with appropriate cutters, and attached to mandrils or spindles,) in a sliding gate, when this is combined with a carriage placed at an angle of about forty-five degrees, with a plane passing through the axis of the chucks, in the manner set forth. And I also claim, in combination with the carriage and the chucks thus arranged, the perforated supporters which sustain the under surface of the board around the cutters, substantially as described."

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2. For an *Improvement in the Cutting Engine for Dividing and Cutting the Teeth of Cog Wheels;* Jos. P. Gaume, Cincinnati, Hamilton county, Ohio, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the puppet which carries the cutter frame in two parts, separated by an inclined plane, that one may slide on the other, for cutting the cogs of bevel wheels, in combination with the cutter frame that slides thereon, as set forth. And I also claim the cutter frame and double puppet, combined together as described, in combination with the mandril of the lathe, as set forth. I also claim the method of adapting the index or division plate, that has but one set of divisions, to any division of cogs desired to be cut, by means of shifting the wheel on the arber that communicates motion to the mandril, in combination with the sliding connexion of the index or division wheel, substantially as described, whereby numerous divisions on the index plate is avoided. And finally, I claim the dividing apparatus, in combination with the mandril of a lathe, by means of a cog wheel and pulleys put on one and the same mandril, substantially as described, whereby the wheels to be cut can be turned and cut on the same mandril, without being removed therefrom to insure good work, and whereby also, the turning lathe may be used for a cutting engine, as set forth."

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3. For an *Improvement in the Machine for Mixing and Tempering Clay;* Jonathan W. Ward, Cambridge, Middlesex county, Massachusetts, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a series of revolvable knives, and one, two, or more rakes, as applied to a mixing trough, and made to operate therewith substantially in the manner set forth."

4. For an *Improvement in Winnowing Machines;* P. H. Watson, Rockford, Winnebago county, Illinois, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the angular rib and groove, with the feedboard, substantially as set forth. I likewise claim the combination of the screens with the swing frame, so as to adjust or graduate their inclination, in such a manner that their slope may be inversely proportioned to the amount of shake or vibratory motion which they severally receive, in the manner set forth."

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5. For an *Improvement in Brick Presses;* C. B. Baker, Troy, Rennselear county, New York, June 6.

The patentee says,—"The nature of my improvement consists in the formation of the follower of the press, by which a vertical motion can be used, and at the same time an equal quantity of clay of uniform density can be pressed into all parts of the mould at the same time."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the follower having projecting edges, as set forth, in combination with the hopper, grating, and brick moulds, substantially in the manner and for the purposes set forth."

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6. For an *Improvement in Brick Presses;* Isaac Gregg, Pittsburg, Pennsylvania, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining of the false bottoms of the brick moulds, the friction roller or other device, and the additional knife, with the said machine, in the manner and for the purpose set forth."

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7. For an *Improvement in the Rotary Bench Hook;* P. C. Cowles, Cabotsville, Hampden county, Massachusetts, June 6.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the construction of the within specified rotary bench hook, with its revolving facilities, by which the hook can be set and made fast by a turn of the binder, in any angle with the bench, with smooth or hook edge, together with the manner in which the cylinder is made and fastened."

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8. For an *Improvement in Planes for Planing Curved and Beveled Surfaces;* William A. Cole, City of New York, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the adjustable metallic spring plate, secured to the face of the plane, for the purpose of planing, with one plane, various curves, either concave or convex, substantially as set forth."

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9. For an *Improvement in Setting Steam Boilers;* Daniel Carpenter, Cohoes, Albany county, New York, June 6.

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the series of upright flues and chambers, in which the gases revolve and are consumed; the partitions between said chambers and the upright or ascending flues being built up in contact with the bottom of the boiler, so that no gas can pass between them."

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10. For an *Improvement in Straw Cutters;* Byron Densmore, Kendall, Orleans county, New York, June 6.

The patentee says,—"The nature of my invention and improvement consists in attaching the knife stock, by means of two oblique parallel vibrating hanging arms, to two horizontal parallel rock shafts, turning in boxes fastened to inclined caps on the top of the frame in front of the knife box, and connecting the knife stock to a revolving crank shaft, turning in boxes below the knife, by means of a connecting or pitman rod, so that the knife shall be operated obliquely against the mouth of the cutting box at the same angle of inclination, the hanging arms preserving their parallelism throughout the entire movement of the knife. Also, in arranging two horizontal parallel screws, in combination with the two inclined cap timbers of the frame that sustain the boxes of the aforesaid parallel rock shafts, for adjusting the knife to the metallic mouth or facing. Likewise, in a new mode of operating the rock shaft of the feed gear, by attaching it to the face of a bevel wheel on the main crank shaft."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is attaching the knife to the arms connected to the rock shafts, in combination with its attachment to the pitman, as set forth."

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11. For an *Improvement in Paddle Wheel Buckets;* P. M. Hutton, Troy, New York, and William Huston, Wilmington, Delaware, June 6.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the application of our peculiar formed bucket to any and all ordinary paddle or driving wheels, of steam or other boats propelled by wheels with buckets in the water, operating fully as an elastic or spring bucket."

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12. For an *Improvement in Sash Stoppers;* W. S. McLean, Allegheny City, Pennsylvania, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the eccentric cam lever to window sash, for the purpose of sustaining the sash when raised or lowered at any point desired, &c.; in combination therewith, I claim the arm to hold the sash down."

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13. For an *Improvement in Punching and Cutting Metallic Sheets;* Wm. H. Danforth, Salem, Essex county, Massachusetts, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The combination of the cylinder, armed with punches, with the perforated traveling bed plate, and the stop or clearer, for punching metallic sheets, &c.

"2d, The traveling and revolving cutters, in combination with the punching cylinder and traveling bed plate, for reducing the width of the sheets, and finishing the edge at the same time, as set forth."

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14. For an *Improvement in Window Frame Pulleys;* Oliver S. Judd, New Britain, Hartford county, Connecticut, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the casting of the frame in one piece, with a cavity in front to admit both wheel and axle at the same time, the cavity of the axle extending into the frame sufficiently to admit the wheel so far as to leave its proper projection in front of the frame face, and having at its end a suitable depression, into which the axle drops, and which serves as bearings to keep the wheel in its place."

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15. For an *Improvement in Smut Machines;* R. Tyhurst, near Shaver's Creek P. O., Huntingdon county, Pennsylvania, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the series of scouring and polishing brushes with the horizontal screen at the base of the beating chamber, substantially as set forth."

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16. For an *Improvement in Shuttles;* Peter Lawson and A. H. Sherman, Lowell, Middlesex county, Massachusetts, June 13.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner in which we arrange the respective parts in combination with the shuttle: that is to say, placing one end of the lever in a groove in the solid end of the shuttle, and the spring adjusting screw in a proper opening under it, said opening being extended through the solid end of the shuttle, so that the adjusting screw may be entirely buried therein, and be operated from the under side of the shuttle; the whole being combined and arranged as set forth, whereby great simplicity, compactness, certainty of action, and durability, are attained."

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17. For an *Improvement in Meat and Vegetable Cutters;* Daniel Deshon, Jr., New London, Connecticut, June 13.

The patentee says,—"The nature of my invention consists, 1st, in the arrangement of the knives, by which each knife cuts in an opposite direction from the other, by cutting across the material acted upon in two directions, and dividing it into small pieces instead of strips, as would be the case were the knives radial, or on the same relative angle to the centre. 2d, The manner of working the pawl, or hand that turns the chopping dish, when a lever is used to move the knife up and down; and 3d, In the combination of the lever with the frame and dish; to bring down the cutter the handle is pressed down, thus holding the frame and dish steady without being fastened, which would not be the case if worked with a crank."

Claim.—"What I claim as new, and desire to secure by letters patent,

is the arrangement and working of the knives, as set forth, so as to cause them to cut steadily in one position, and mince the material fine, without stirring the material up, as set forth, by means of the cross position of the blades and method of working them, without changing their relative position to the frame.

"2d, The method of moving the dish, by means of the pawl combined with the movable fulcrum, and worked by the straight lever that vibrates the knives."

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18. For an *Improvement in Separating Straw, &c., from Wheat;* E. S. Snyder, Charleston, Jefferson county, Virginia, June 13.

Claim.—"What I claim as my invention and desire to secure by letters patent, is, 1st, Reducing the spaces between the inclined perforated slats, by means of pins, reticulated wire, or other means, for the purpose of preventing the straw passing through the same along with the grain.

"2d, I claim making the separation with a transverse riddle and screen, for cleaning the grain of impurities, attached to, and moving with, the conveyor or separator.

"3d, I claim as my invention, arranging a horizontal bar or timber, and apron, across the front end of the trunk in which the separator moves, next the receiving end, for the purpose of arresting the back movement of the straw when the separator moves towards the threshing machine, by which the accumulated mass of straw upon the separator is forced along, over the slats of the separator to the discharging end thereof, as described.

"4th, I claim placing the discharging end of the separator upon a horizontal roller, or other similar equivalent, and suspending the receiving end of the separator, by means of oscillating straps, or chains, or rods, or other fixtures, attached to uprights of the frame, and to the ends of the cross-bar, secured to the separator near the middle thereof, so that while the discharging end is caused to receive a horizontal reciprocating movement, the receiving end is made to rise and fall as it moves to and fro, in order to cast the straw towards the discharging end, and the grain towards the riddles.

"5th, I claim making the tangential spout of the fan case with a horizontal partition, to which are fastened the ends of a number of parallel elastic fingers, for the purpose of catching and tripping whatever straw may chance to pass through the separator, and for feeding the riddle."

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19. For an *Improvement in Piano Fortes;* J. H. Schomacker, Philadelphia, Pennsylvania, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The construction and arrangement of a sounding board, disengaged from the sides of the case, using for that purpose any props or supporters that will produce the desired effect.

"2d, Also the construction of a metallic plate, with a groove or grooves on the edge or edges, through which the pins to which the strings are attached, are introduced by holes or apertures, passing, as described, through both sides of the groove, so that the strings shall be attached to said pins within said groove or grooves.

"3d, The application of candlesticks or candelabras to piano fortes, on either side of the note desk, so as to conceal them in the recess under the note desk."

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20. For an *Improvement in Cotton Presses;* W. B. North, Jersey City, Hudson county, New Jersey, June 13.

Claim.—"What I claim as new, and desire to secure by letters patent, is the so combining of three, or any other convenient number, of iron or wood rollers, as that said rollers may be made to approach and recede from each other, in a manner substantially the same as herein set forth, the cotton to be pressed being carried into the space between said rollers by means of an endless feeding apron, and rolled upon itself in successive layers until the required quantity has been accumulated, as herein set forth."

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21. For an *Improvement in the Water Wheel and Flume;* Samuel Streeter, Detroit, Wayne county, Michigan, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the connexion of flat inclined buckets and conical rim, and the centre of the wheel covered by a conical surface of the flume, in combination with the partitions of the flume, to prevent water riding round on the centre of the wheel, to prevent surging, thereby giving the water a downward direction only."

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22. For an *Improvement in Propellers;* Elisha F. Aldrich, City of New York, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the application of the cut off, as herein described, which prevents the water from passing between the floats at the after part of the wheel, and by the use of which a vacuum is formed in the cases in which the wheels revolve."

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23. For an *Improvement in Tailoring Apparatus;* Charles Lucas, Charlottsville, Jefferson county, Virginia, June 13.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of a sheet of patterns or diagrams, with their scales and system of graduation and rotation, such as are described, in combination with a flexible adjustable measure corresponding thereto, the same being made and used as set forth."

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24. For an *Improvement in the Hydraulic Chill, for Chilling Car Wheels, &c.;* Jordan L. Mott, City of New York, June 13.

Claim.—"I do not claim as my invention, the mere use of water for the purpose of preventing tools from overheating, or for the purpose of cooling castings; but what I do claim as my invention, and desire to secure by letters patent, is the method of preventing chilled castings from being annealed, by passing a current or currents of air through or around, or by

immersing the chill in water, whereby the heat of the internal mass is permitted to pass off without heating the chilled surface, and chilled to a temperature sufficiently high to produce an annealing effect, as described."

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25. For an *Improvement in Water Wheels;* Lewis Wertz, Chambersburg, Franklin county, Pennsylvania, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the cap with the inner ends of the converging buckets and the collar, for the purpose of forming a pocket or channel to prevent the water from spreading out laterally when it first acts against the wheel, and keeping it in a solid compact current until finally discharged, whereby an increased amount of useful effect is obtained, as set forth. I likewise claim the combination of auxiliary converging shutes with the principal shutes and the wheel, as set forth."

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26. For an *Improvement in Kiln Drying Grain;* John H. Tower, Kirkland, Kirkland county, New York, June 20.

The patentee says,—"The nature of my invention consists in passing the grain in a peculiar manner through a revolving and heated cylinder, composed of separate square apartments or tubes, made of sheet iron, fourteen feet long."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the grain dryer: that is to say, arranging a series of tubes, similar to those described, in a cylindrical form, to be operated by a revolving shaft, in the manner set forth."

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27. For an *Improvement in Cultivators;* Dummer Pattee, Ypsilanti, Washtenau county, Michigan, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of attaching and regulating the front sheath, and in combination therewith, the manner of regulating the depth of cultivation, as set forth."

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28. For an *Improvement in Moulding and Pressing Brick;* John Booth, Mobile, Mobile county, Alabama, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is, 1st, The method of discharging the bricks from one set of moulds whilst the others are being filled, by the combination, arrangement, and operation of the reciprocating sliding bar, made with two inclined ends, and the plates, having two inclined grooves formed on the under sides thereof, in which said inclined ends of the bar slide back and forth reciprocally, said plates being attached to the vertical parallel sliding rods to which the pistons are secured.

"2d, I claim, also, the mode of relieving the lower sides of the bricks before the pistons commence discharging the same, by causing the plate and board to descend a limited distance, and making the spaces between the upper surfaces of said plates and the under edges of the moulds, after

the discharge of the brick from the same, greater than the thickness of the bricks, to allow them to be removed without touching the moulds, by raising the nuts on the ends of the rods, (passing loosely through the transverse timbers,) and forming shoulders in the rods a short distance below the under sides of said timbers, as set forth."

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29. For an *Improvement in Sofa Bedsteads;* John C. Emery, Concord, Merrimac county, New Hampshire, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is one or more pendulous bars applied to the end or ends and back board, in combination with one or more stops, or their mechanical equivalents, applied to the bottom board, the whole being arranged and operating substantially as set forth."

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30. For an *Improvement in Straw Cutters;* John Romans, Romansville, Chester county, Pennsylvania, June 20.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of cutting straw, hay, fodder, and other substances, by means of the movable holder, in which the substance to be cut is confined, being made to move in the arc of a circle, towards and from the rotary cutter, in combination with the revolving cutter and knife, whose axis remains unchanged, the several parts being arranged and operated as set forth. I also claim the mode of feeding, by moving the holder in an arc of a circle round to the reaching arm, bringing the cog wheel of the feed roller in contact with the reaching arm, after the mouth of the box has moved from the knife, as described. I likewise claim the arrangement of the false bottom, in combination with the vibrating holder."

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31. For an *Improvement in Carding Cotton, Wool, Flax, &c.;* Stephen R. Parkhurst, West Bloomfield, Orange county, New Jersey, June 20.

Claim.—"What I claim as new, and desire to secure by letters patent, is the application of the steel ring hooked tooth cylinders, to act as combers, workers, and doffers, in combination with common wire tooth carding, for the purpose of quicker and more effectively opening wool and other fibrous materials, in the process of carding the same, as set forth."

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32. For an *Improvement in Propelling Vessels;* Robert L. & Francis B. Stevens, New York, June 20.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is applying air to the immersed surface of a vessel in motion, as described, and thus interpose, by a continuous or intermittent supply, a stratum of air between the immersed surface, or portions thereof, of the vessel, and the water, for the purpose of reducing the friction of the water. We do not claim this application to propel the vessel, but to be used in connexion and combination with paddle wheels, screws, sails, or other propelling agent. We also claim the recesses on the immersed surface of the vessel, formed by the scales or other irregularities, or anything sub-

stantially the same, when combined with the supplying of air, for the purpose of distributing the air, and for retaining it more perfectly and for a longer time between the surface of the vessel and the water; but it is to be understood that we do not claim those recesses independently of their connexion with the use of air to reduce friction. We also claim the plates over the air apertures, or the seals, or ribs, in front, as described, to reduce the pressure required for the discharge of the air, but this we claim only when air is used as a means of reducing friction. We also claim the apertures made in the stern of a vessel, communicating with the atmosphere by pipes or other conductors, for the purpose of diminishing that resistance produced by the motion of the vessel from the motion of the water, commonly called the suction of the stern; we do not claim the use of these apertures excepting in connexion with paddle wheels, screws, or other propelling agent."

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33. For an *Improvement in Water Wheels;* F. M. Hemphill and Robert H. Knox, Washington, Fayette county, Ohio, June 20.

The patentees say,—"The nature of our invention consists in constructing a wheel that shall run while flooded, without being smothered in the tail-water, the curve and pitch of the bucket, and the direction of the water thereon from the shute, being such that the waste power of the water, after it leaves the wheel, shall be expended to force back the surrounding column, so as to leave the wheel free, and combining the wheel with the shute, in such a way as to permit it to be raised and lowered by the bridge-tree in which it is stepped, there being a rim around the outer edge of the wheel that just fits the rim of the shute inside, and a recess being formed inside the buckets and inner rim of the wheel, which is made to fit the inner rim of the shute, the wheel being thereby susceptible of being raised and lowered by the bridge-tree, in a manner similar to that now employed in grist mills to raise the runner stone."

Claim.—"What we claim as new, and desire to secure by letters patent, is, 1st, Constructing the wheel as set forth, with an outer and inner rim, to fit the shute in which it runs, in such a way that the wheel can be raised or lowered in it without affecting the leak of water, the wheel and shute being so formed as to clear the tail-water, in the manner specified.

"2d, We claim the safety valve in the shute, attached thereto in the manner and for the purpose set forth."

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34. For an *Improvement in the Sofa Bedsteads;* Sherman Blair, New Haven, New Haven county, Connecticut, June 27.

The patentee says,—"The nature of my invention consists in introducing under the usual seat of a sofa, (or other proper article of furniture,) which seat is so arranged as to be drawn forward nearly its whole width, and to be supported in a horizontal position by legs attached thereto in the usual manner, a movable seat of sufficient dimensions to fill the open space thus left, which may be raised to a level with the ordinary seat, and forms a wide and level surface for a bed."

Claim.—"What I claim as my invention, and desire to secure by letters

patent, is the introduction of a movable seat under the ordinary seat of a sofa, lounge, or other proper article of furniture, so arranged as to be drawn up and sustained upon a level with the ordinary seat, when drawn forward, thereby forming a broad level surface sufficient for a bed."

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35. For an *Improvement in the Form of Teeth or Cogs, for Racks and Pinions, and otherwise for various purposes;* A. C. Semple, Cincinnati, Hamilton county, Ohio, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the form of the teeth or cogs, both in the rack and in the pinion meshing into the same, either diagonal, or arched, or curved, whereby strength and accuracy of motion are the better secured."

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36. For an *Improvement in Planing, Tongueing, and Grooving Plank;* Calvin Emmons, City of New York, June 27.

The patentee says,—"The nature of my invention consists in the construction and combinations of the several parts."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the lever frame, cam wheel, and plane stock, substantially in the manner set forth, by means of which combination, and the configuration of the cam wheels and the plane stock, which is made to move in a different and lower line during its forward stroke, than during its backward stroke, in the manner and for the purposes set forth.

"2d, The combination and arrangement of the tongueing and grooving planes running with the slides, and the mode of adjusting the same in combination with the surface plane, the cam wheels, and levers, substantially in the manner set forth, for tongueing, grooving, and planing boards at one operation.

"And finally, The mode of contracting and expanding the grated bed, in the manner set forth, in combination with the tongueing and grooving planes."

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37. For an *Improvement in Bedstead Fasteners;* James C. Helme, Wilkesbarre, Luzerne county, Pennsylvania, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing a double right and left hand fastener, for securing the rails to the posts of bedsteads, by means of the radial clutching arms, combined with metallic disks and rings, and operating with each other substantially as set forth, in both modifications of my improved bedstead."

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38. For an *Improvement in Bedstead Fasteners;* Spencer Lewis, Tiffin, Seneca county, Ohio, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the casting of the lock for the keys of both the rails which meet at one post in one solid piece of metal, having two mortices and four segments of screw threads, for receiving and securing the tenon, by which

the locks may be secured in the post without screws, and the fastening made more substantial, and with less labor and expense."

39. For an *Improvement in Coupling Joints for Uniting Pipes, &c.;* Uel West and Nathan Thompson, Jr., City of New York, June 27.

The patentees say,—"The principal character of our invention consists in forcing together the two bodies to be coupled or connected, by means of a grooved segmental clamp, the groove of which embraces flanches (or their equivalents) projecting from, or connected with, the bodies to be coupled, so that when the said segments are drawn together by screw bolts, keys, conical wedge rings, or any equivalent means, the groove therein shall act on the said flanches, or their equivalents, to force them together, and thus make a tight joint with or without interposed packing."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of coupling joints by means of flanches, or their equivalents, in combination with a grooved segmental clamp, the groove of which is formed to embrace the flanches, and which, when drawn or forced together by screw bolts, or other equivalents, will force and hold together the flanches, as set forth."

40. For an *Improvement in Grates for Cooking Stoves;* Roswell Wilson, Half-Moon, Saratoga county, New York, June 27.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of a screw (for the fuel to rest upon) with the sides of a furnace, substantially in the manner and for the purpose set forth."

41. For an *Improvement in Raising Water;* J. L. Letellier, Paris, France, June 27.

The patentee says,—"The nature of my invention consists in a modified form and application of the well known Archimedian screw, by which a portion of air is introduced with the column of water, so as to render it elastic, and cause it to ascend to a much greater height than by the ordinary method employed for that purpose, and in the construction of the screw, so proportioning the parts as to cause the best effect in elevating water, and thus reduce the power used to turn the machine to its minimum."

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the Archimedian screw, substantially in the manner set forth, viz. by gradually contracting the same, and so placing it as to receive a portion of air at each revolution, for the purpose of rendering the column elastic, as described; and in conjunction therewith, I also claim the axial tube, through which the water is made to ascend from the screw to the desired height, for the purpose intended."

42. For an *Improvement in Manufacturing Door and Gate Springs;* Franklin Kellsey, Middletown, Connecticut, June 27.

The patentee says,—"The nature of my invention consists in the construc-

tion of a frame or barrel, whereby I am enabled to apply a spiral spring, regulated by a jointed lever, and thereby obtain an equal pressure upon the door or gate, as also to turn the dead point, by the lever applying the power of the spring, to keep the door or gate open as well as shut."

Claim.—"What I claim, as my invention, and desire to secure by letters patent, is the mode in which I make my frames or spring barrels, and attach the springs to the same, together with their application to the shutting and holding open of doors, gates, window shutters, and other similar purposes."

Report of the Commissioner of Patents for the year 1848.

(Continued from page 259.)

The report of this office upon the condition and statistics of agriculture during the year 1848 is annexed, marked I.

On reference to the table of the estimated crops for the year 1848, it will be seen that they exhibit generally a very sensible increase over those of former years. The careful and scrutinizing observation of every cause which can affect the growing crops in every section of the country during the year, which is made at this office, enables me to state that the past year has been very favorable to the growth of the great staples, as well as the minor agricultural products of the Union.

The quantity of wheat raised in the United States during the last year will, according to the estimates of this office, not be less than 126,000,000 bushels. The quantity of corn produced is estimated to be about 588,000,000 bushels; oats, 185,000,000 bushels; potatoes, 114,000,000 bushels; rye, 33,000,000 bushels; buckwheat, 12,500,000 bushels; barley, 6,222,000 bushels; hay, 15,735,000 tons; hemp, 20,330 tons; cotton, 1,066,000,000 pounds; tobacco, 219,000,000 pounds; rice, 119,000,000 pounds; and sugar, (in Louisiana,) 200,000,000 pounds.

Thus it will be seen that the agricultural productions of the Union during the last year are ample for the consumption of the country; and of many varieties of grain and provisions, large surpluses will be left for exportation to other countries.

There is probably no other country in the world whose agricultural industry exhibits a more rapid and steady progress than that of the United States. Its population is rapidly augmenting by natural increase and by immigration, and every year large quantities of new land are reclaimed from the wilderness, and subjected to cultivation. The number of cultivators and the breadth of soil are rapidly increasing with each succeeding year; and as Providence yet spares our favored country from the visitations of dearth and famine, which have afflicted other less favored countries, the amount of agricultural products must necessarily increase in equal proportion.

Every year adds also to the skill of our agriculturists, and to improvement in agricultural implements, and thus, too, is the amount of production annually augmented.

The minute and searching inquiries which this office causes to be made

in relation to the condition and interests of agriculture in every neighborhood in the Union, enable the undersigned to speak positively of the increasing activity and energy of our enterprising and intelligent farmers, and their constant advancement in the knowledge and practice of their great and transcendent art—transcendent in importance when viewed as the great minister to the absolute wants and necessities of man, and the indispensable foundation of all civilized communities and nations.

The world has, within comparatively a few years, learned that agriculture offers an almost illimitable field for the operations of the scientific as well as practical experimenter. Its full development seems to require the application of all the physical sciences in some form or other—in the analyses of soils; in the nature, structure, and habits of plants; in the food of plants, and in the adaptation of soils and manures to their sustenance and growth; in the improvement of the races and breeds of animals; in the invention and improvement of useful implements and machines; and, finally, in political economy, which points the agriculturist to the contemplation of his interests, as they may be affected by the institutions and the legislation of governments. Viewed in this light, agriculture may truly be regarded as the most important, dignified, elevated, and honorable pursuit in which man can engage. The intellectual qualifications which the cultivation of the science of agriculture requires, are, therefore, not second in degree to those which are necessary for the pursuit of any other science. Hence the importance of study, experiment, and close observation on the part of the agriculturist. All who may be engaged in that elevating and ennobling pursuit may not have the time, nor the opportunity, to become thoroughly versed in the philosophy which lies at its foundation; but, in a life devoted to its practice, the humblest will have the time and opportunity to acquire much interesting and valuable knowledge.

At the last session of Congress an appropriation was made of $1000, for the institution of a system of analyses of the different grains produced in this country, and of flour manufactured here and exported abroad. The two most important problems which it was deemed desirable to have solved in reference to this matter, were the effect of soil and climate upon the different varieties of grain produced in this country, and the effect of a sea voyage and storage upon the flour and meal manufactured from grain produced here and sent abroad.

For this important work I engaged the services of Professor Beck, of New Brunswick, New Jersey, an experienced analytical chemist, who has been occupied during the past season in the execution of the investigations confided to his charge, and who has submitted to me a most interesting and valuable report, which will be found in the appendix to the agricultural report, marked No. 1.

As there was but little time, after the investigation was authorized, before it became necessary to commence the work, I had not the opportunity to procure as many samples of grain and flour for experiment as I desired. Yet a large number of analyses have been made, and the results are embodied in the report of Professor Beck. I am now receiving samples of wheat, corn, and flour, from the ports of the most distant countries to which they have been exported; and if Congress shall continue the appropriation

necessary for the investigation, more numerous results may be anticipated for the next report from this office.

The investigation in which Professor Beck is now engaged, under my direction, promises not only results of much scientific value, but it will furnish very valuable information to the manufacturers and exporters of flour and grain. It is hoped, therefore, that provision will be made by Congress for its continuance.

Deeming it of importance that a correct historical, statistical, and practical view of the great staples of the southern portion of the Union, which form so large a part of the exports of this country, should be given to the world in an authentic form, I have devised the plan of instituting close and searching investigation into the history, progress in culture, and present condition of the great staples of sugar, cotton, tobacco, and rice, which, if circumstances will permit, I shall pursue from year to year until my purpose shall have been attained.

As a commencement of this system of investigation, I employed an intelligent and able gentleman, Charles L. Fliechmann, Esq., to visit Louisiana during the last season, to make inquiry into the condition and progress of the sugar culture in that State. He has accomplished, in part, the object for which he was sent, and has presented to me a most valuable report, which will be found in the appendix to the agricultural report, marked No. 2.

As the time which was allotted to him for the execution of the investigation committed to his charge, was not sufficient to enable him to complete his inquiries, it will be necessary for him to resume his labors during the approaching season. His report, although necessarily incomplete, it is believed contains much valuable information, which will be interesting to the public at large, and particularly useful to the intelligent and enterprising citizens engaged in the sugar culture in this country. The circulars sent out from this office, soliciting information upon the subject of agriculture, were very full and minute in the inquiries which they embodied, and the replies to them, many of them equally minute, contain a large amount of valuable and interesting information, which will be found embodied in the agricultural report and appendix. This office is under great obligation to the intelligent gentlemen who have so promptly and fully responded to its inquiries. And particularly is it indebted to J. De Bow, Esq., of New Orleans, Charles Cist, Esq., of Cincinnati, B. P. Johnson, Esq., of Albany, M. B. Batchem, Esq., of Columbus, Ohio, J. Delafield, of Seneca county, N. Y., T. Marshall Painter, Esq., of Luzerne, Pa., and N. J. Wythe, Esq., of Cambridge, Mass., for interesting and valuable communications.

Heretofore, collections of such seeds for the field and garden as were deemed most valuable, have been obtained for distribution from this office. During the last year, nearly 70,000 packages were distributed. This year nearly as many have been obtained, and will be distributed to the members of Congress before the adjournment of the present session. Most of them have been obtained from seeds presented to this office by M. Vattemare, the enlightened founder of the system of national interchanges, and by F. Hagedorn, Esq., the Bavarian consul at Philadelphia, which were presented by their respective governments, through their agency, to this office. The seeds thus obtained were placed in the hands of an intelligent gardener

for cultivation, and those which succeeded best in our soil and climate, and appear to be of superior varieties, have been preserved for distribution. Native seeds have also been obtained, and will be distributed.

This office is also indebted to Lieutenant Lynch, the commander of the expedition to the Dead Sea, for many interesting varieties of seeds, which have been kindly placed at the disposal of this office by the Secretary of the Navy, and will form a part of the seeds distributed during the present year.

Much complaint has been made by inventors on account of the appropriation of a small portion of the Patent Fund, each year, for the agricultural report. And I have heretofore sympathised in such complaints.—Mature reflection, however, has convinced me that no injustice is done to the interests of inventors by such an application of the Patent Fund; but, on the contrary, the interests of the Patent Office, and of inventors themselves, have been subserved by it. The agricultural report of the office, by its wide dissemination throughout the country, has contributed much to increase the reputation and influence of the Patent Office, and to spread more widely among the people a knowledge of the new inventions and improvements which have been made during the year. And thus it promotes the interests of inventors, by contributing to the more rapid introduction and sale of their machines and improvements. Therefore, in the opinion of the undersigned, there is hardly any object to which the small appropriation made for the agricultural report could be applied, which would benefit inventors more than the preparation and publication of that document.

In the pursuit of its statistical investigations, this office has keenly felt the want of means for obtaining accurate and reliable information concerning the great industrial interests of the country. No provision has been made by the general government for obtaining such information, except in relation to the foreign commerce of the country, and but very few of the States have adopted measures for obtaining authentic information in relation to their industrial interests. Massachusetts and Louisiana are in advance of most other States in their legislation upon these subjects. In the former State very full returns are obtained, in small periods of a few years, if not annually, of its industry and resources; and in the latter a bureau of statistics has been established, at the head of which has been placed one of her most intelligent and talented citizens.

A most interesting view of the vast resources of this great republic would be annually exhibited, if all the States should follow the example of Louisiana and Massachusetts. The statesman and legislator, to whom the people commit the destinies of their common country, would then have at their hands ample material to aid them in the intelligent discharge of their momentous and responsible duties, without which they are like blind men feeling their way in the dark.

The next census, if the plan for taking it shall be well systematized and digested, will supply much valuable statistical information in relation to the population, industrial interests, wealth, and resources of the republic.

The patent system of the United States having existed in some form or other for nearly sixty years, and having now become a very important and interesting institution, I came to the conclusion that a brief statistical notice

of the legislation affecting it, its financial operations, and the progress of invention as exhibited by its records, was much needed, and would be appropriate as a part of the annual report of this office. I have accordingly prepared such a statement, which is annexed, marked H. The table exhibiting the history and progress of the inventive genius of the United States contains, in a brief space, many valuable, interesting, and striking facts, which cannot fail to arrest the attention of the intelligent observer.

The increasing business of the Patent Office has added so much to the duties imposed upon the Chief Justice of this District, who was, by the act of March 3, 1837, constituted a court of appeals from the decisions of the Commissioner of Patents, that the present compensation which he receives for that service is wholly inadequate to the labor which he is required to perform. He now receives $100 per annum as the Judge of Appeals from the Patent Office. Within the knowledge of the undersigned, there has been a single case before the Chief Justice, involving an amount of labor and time, which, if devoted to any other pursuit requiring the same talents and attainments for its execution, would have commanded treble the sum he receives for his services in that capacity for the whole year. It would be just, therefore, that the present compensation of the Chief Justice should be increased to an amount which would be adequate to the duties and labors with the law imposes upon him.

The liberal provision made by Congress, each year, for the library of the Patent Office, has secured extensive and valuable additions to its size and usefulness. When I first assumed the duties of Commissioner it contained about 3000 volumes, it now contains over 6000 volumes, which are mainly scientific in their character. A small portion of them relate to agriculture, statistics, and political economy, and are very necessary to facilitate the investigations with which the office is charged, concerning the great industrial interests of the country.

The vast number of books and periodical publications, of a scientific character, now in existence, renders it extremely desirable that a general index, containing sufficient reference to the various volumes to enable the scientific investigator to understand the nature of their contents, should be prepared for the use of the public. Such a compilation is desirable in reference to all works of science, and it would be particularly useful and labor-saving in the Patent Office. I have, therefore, deemed it proper to recommend that a small sum be appropriated, each year, from the Patent Fund, for the preparation and continuation of such a digest of the books and publications now in the library of the office, and of such as may be hereafter added to it. The work should, of course, be confided to competent hands, and, when completed, it should be printed for more convenient use. If it would be deemed proper to put the work on sale for the benefit of the Patent Office, it would unquestionably enable the office to realize much more, from its disposal in that way, than its compilation and publication would cost.

As Professor Henry, the distinguished Secretary of the Smithsonian Institution, contemplates such a compilation for the library of that institution, the two works might be blended, and a most valuable index to the vast treasures of science would thus be given to the world.

The business operations and finances of the Patent Office have expanded

rapidly within the last four years. This fact will become more strikingly visible by a contrast of the progress of the office for the last four years with its progress for the four years next preceding. The following statement will exhibit this contrast, viz:

Year.	Number of applications.	Number of caveats.	Number of patents issued.	Amount received for duties & fees.	Balance carried to Patent Fund, after deducting expenditures exclusive of money paid for restoring models, &c.
1841	847	312	495	$40,413·01	$8,253·84
1842	761	291	545	36,505.63	5,292·20
1843	819	315	531	35,315·81	4,588·85
1844	1045	380	502	42,509·26	6,164·79
Total,	3472	1298	2073	154,743·71	24,299·68
1845	1246	380	511	51,076·12	11,680·49
1846	1272	448	619	50,264·16	4,105·45
1847	1531	533	572	63,111·19	21,232·84
1848	1628	607	660	67,576·69	8,670·85
Total,	5677	1968	2362	232,028·16	45,689·63
	3472	1298	2073	154,743·71	24,299·68
Excess,	2205	670	289	77,284·45	21,389·95

It will be thus seen that the number of applications for patents received during the last four years exceeds the number received during the next preceding four years, by 2205; the number of caveats by 670; the number of patents granted by 289; the amount of receipts from all sources by $77,284·45; the balances paid into the treasury to the credit of the Patent Fund by $21,389·95.

It should be remarked, in reference to these results, that, during the first period of four years, more than half the applications for patents were granted; whereas, during the last four years, as has been before remarked, not much, if any, more than three-fifths of them have been granted.

It is also necessary to observe, that during the first four years there was expended for the restoration of models, &c., the sum of $41,977·31. If this disbursement had been charged to the account of the expenditures of the office, there would, instead of being an excess of receipts over expenditures of $24,299·68, have been a deficiency of $17,677·63. The Patent Fund, therefore, instead of being actually increased, was diminished in the amount last mentioned, during the first period of four years.

During the second period of four years, the sum of $5257·64 was paid out for the restoration of models, &c. This sum has been reckoned in the account of expenditures for that period, and only the actual balance stated, which was carried to the credit of the Patent Fund. Consequently, the Patent Fund has been increased during that period, in the sum of $45,689·63. On the first day of January, 1845, the Patent Fund amounted to the sum of $170,779·20. On the first day of January, 1849, it amounted to the sum of $216,468·83.

This contrast of the business operations and finances of the office during

the two periods above stated, is not made with a view to institute an invidious comparison between the administration of my immediate predecessor and myself—on the contrary, the affairs of the office were administered with great ability, prudence, and economy, by the late Commissioner; but it is made with a view to show the progress of the institution during the last four years; which is also interesting as an indication of the progress of the country in population and wealth, and in the cultivation and improvement of science and the useful arts.

The exhibit which I have made in this and previous portions of my report, of the affairs and business of the Patent Office, show that it will soon be necessary not only to enlarge the Patent Office building, but to increase its clerical force. And as it required three years of persevering effort on my part, sustained by the auxiliary aid of loud complaints on the part of applicants for patents, growing out of the delay occasioned by the great accumulation of business which could not be done, to obtain the late addition which has been made to the clerical force of the office, I have deemed it my duty now to apprise Congress that but a very few years will elapse before another addition to its force will be necessary. As the office sustains itself from its own revenues, it seems reasonable that it should be allowed a force sufficient for the prompt and efficient execution of its duties.

The law requires the Commissioner of Patents to report to Congress the operations of the Patent Office from January to January, and not from July to July, as in other branches of the government. Consequently, the report of the office cannot be commenced until after the calender year expires. The Commissioner, therefore, is allowed, comparatively, but a very brief period for the preparation of his report, particularly in short sessions of Congress. Thus hastily prepared, it must necessarily be imperfect. And, in the desire of the undersigned to make his report at as early a day as possible during the present session, he has been necessarily compelled to defer the preparation of several tables required to illustrate the subjects treated of in the report, until they will be needed by the printer. This explanation was deemed necessary to account for their absence.

All which is respectfully submitted. EDMUND BURKE,
Commissioner of Patents.

To the HON. ROBERT C. WINTHROP, *Speaker of House Representatives.*

MECHANICS, PHYSICS, AND CHEMISTRY.

Report on the Gases evolved from Iron Furnaces, with reference to the Theory of the Smelting of Iron. By Prof. BUNSEN, *of Marburg, Hesse Cassel, and* Dr. LYON PLAYFAIR, *of the Museum of Economic Geology, Department of Her Majesty's Woods and Forests.*

From the Report of the British Association for the Advancement of Science, for 1845.

(Continued from page 279.)

The nature of the gases ascending through the various parts of an iron furnace is obviously dependent upon the nature of the fuel used in it.—Coke, brown coal, and wood, yield a gas containing as combustible con-

stituents only carburetted hydrogen, carbonic oxide and hydrogen. The analysis of such a mixture offers no difficulties, and the proportion of gases may be easily calculated if we are acquainted with the volume occupied by the oxygen which disappears, and that of the carbonic acid produced, referring them to the volume of gas employed.

A mixture of gas consisting of	1 vol. H + 1 vol. H_2C + 1 vol. CO	= 3 vol.
requires for combustion	$\frac{1}{2}$ vol. O + 2 vol. O + $\frac{1}{2}$ vol. O	= 3 vol.
and yields	1 vol. CO_2 + 1 vol. CO_2	= 2 vol.

If we call any given mixture of gas A, consisting of x hydrogen, y light carburetted hydrogen, and p carbonic oxide; and further call the oxygen necessary for the combustion B, and the carbonic acid produced C, we obtain the following equations:—

$$x+y+p=A,$$
$$\tfrac{1}{2}x+2y+\tfrac{1}{2}p=B,$$
$$y+p=C;$$

and out of these follow

1. $x=A-C.$
2. $y=\dfrac{2B-A}{3}.$
3. $p=C-\dfrac{2B-A}{3}.$

But the gas generated, when coal is used as fuel, may contain, in addition to the above gases, olefiant gas, gaseous hydrocarbons of various compositions, and sulphuretted hydrogen. The examination of such a complex mixture of gases offers rare difficulties, which may be overcome by estimating directly the sulphuretted hydrogen and the hydrocarbons differing in composition from light carburetted hydrogen. Sulphuretted hydrogen is easily enough determined, but for the estimation of hydrocarbons, not even an approximative method is known. It is quite true that they may be condensed by free chlorine in the dark; but the necessity of making such experiments over water render the results wholly inexact. This method also gives a source of error, which becomes materially increased by the circumstance that the tension of the substance containing chlorine formed by the condensation cannot be brought into the calculation. We have, therefore, tried to condense the gases in a proper apparatus by means of perchloride of antimony. In order to be sure of the applicability of this substance, it was necessary to be certain that this compound of chlorine kept back the desired hydrocarbon without acting upon the remaining constituents of the mixture. It may easily be proved that carbonic oxide, light carburetted hydrogen, and hydrogen, are left quite unchanged by it, for after streaming through the liquid contained in a Liebig's potash apparatus, they are again obtained unaltered in quantity or in properties. But it was not so simple to decide whether olefiant gas and the other hydrocarbons of unknown composition were separated in this way pure and capable of quantitative determination. We have endeavored to decide this question in a way certainly somewhat tedious, but not the less positive. In the first place, it was necessary to be satisfied of the correctness of the

opinion generally received, but, as far as we are aware, unproved, that the gaseous products of distillation of coal, in addition to carbonic oxide, hydrogen, olefiant gas, and carburetted hydrogen, still contained other hydrocarbons. If the latter be absent, we are able, by a eudiometric analysis, to determine the constituents of a mixture of gases containing four ingredients, if we estimate for a given volume of the mixture A, the quantity of oxygen necessary for its combustion B, and the carbonic acid thus formed C, and also the proportion of the latter to the amount of aqueous vapor produced. Thus it requires

A mixture consisting of	1 vol. H + 1 vol. H_2C + 1 vol. HC + 1 vol. CO	= 4 vol.
for combustion	½ vol. O + 2 vol. O + 3 vol. O + ½ vol. O	= 6 vol.
from which is produced	1 vol. CO_2 + 2 vol. CO_2 + 1 vol. CO_2	= 4 vol.
and also	1 vol. HO + 2 vol. HO + 2 vol. HO	= 5 vol.

If we denote these quantities by the same letters as above, the olefiant gas by z, and the proportion of the aqueous vapor produced by the combustion to the carbonic acid as $\frac{D}{E}$, the following four equations result:

$$\begin{aligned} x+y+z+p &= A, \\ \tfrac{1}{2}x+2y+3z+\tfrac{1}{2}p &= B, \\ y+2z+p &= C, \\ \frac{x+2y+2z}{y+2z+p} &= \frac{D}{E}, \end{aligned}$$

The value of the four unknown quantities x, y, z, and p, are thus determined:—

$$4.\quad x = 2A+4B-3C\left(\frac{D}{E}+\frac{4}{3}\right).$$

$$5.\quad y = -2A-6B+5C\left(\frac{D}{E}+1\right).$$

$$6.\quad z = A+4B-3C\left(\frac{D}{E}+1\right).$$

$$7.\quad p = -2B+C\left(\frac{D}{E}+2\right).$$

If the mixture of gases contain actually only the four assumed constituents, we obtain positive values for x, y, z, and p. If one of these quantities be negative, this is a proof that the mixture must contain other compounds than those assumed.

In order to obtain something conclusive as to the nature of coal gas, a quantity of coal was heated to redness in a combustion tube, in such a manner that the gaseous products of distillation were not obliged to traverse the red-hot layers of coal. The gas was first conducted into a cool receiver, where it deposited the liquid products of distillation, after which it was freed from carbonic acid and sulphuretted hydrogen, by means of a solution of oxide of lead in potash, and also from water by being made to pass through a tube filled with chloride of calcium, leading into a eudiometer standing over mercury. An indefinite quantity of the gas was also led

over red-hot oxide of copper, and yielded 0·23749 grm. carbonic acid and 0·2239 grm. water, which correspond with 120·55 cubic centimetres of carbonic acid, and with 277·27 cubic centimetres of aqueous vapor. The eudiometric analysis gave the following result:—

	Volume.	Temp. Cent.	Pressure.	0° C. 1 m.
		°	m.	
Volume of gas used,	132·1	2·3	0·4127	54·06
Volume after admission of oxygen,	348·7	0·3	0·6289	219·10
Volume after combustion,	241·3	0·2	0·5277	127·25
Volume after absorption of carbonic acid,	182·8	— 3·0	0·4794	88·61
Volume after admission of hydrogen,	300·3	— 2·5	0·5952	180·39
Volume after combustion,	106·1	— 1·7	0·3987	42·57
Volume after another admission of hydrogen,	295·0	— 1·7	0·5863	174·04
Volume after combustion,	106·2	— 1·5	0·4194	44·79

In these data, and also in all those which follow, the tension caused by the aqueous vapor formed during the combustion is never neglected, and the correction necessary for it at the given pressure, is already brought into the calculation. A simple consideration of these experiments gives us the following values for the elements necessary to the calculation:—

$$\frac{D}{E} = 2{\cdot}2993,$$

$$A = 54{\cdot}0600,$$

$$B = 76{\cdot}0200,$$

$$C = 38{\cdot}6400.$$

These quantities lead us to the following composition:

Light carburetted hydrogen,	+73·18
Carbonic oxide,	+14·08
Hydrogen,	— 8·89
Olefiant gas,	—24·33

In this case, therefore, the formula leads to an impossible result, which proves that other constituents must be in the mixture of gases. From these facts we may also derive another conclusion. If we deduct in the last four experiments, the excess of oxygen left after the combustion from the volume of gas measured after the absorption of carbonic acid, the remainder will give the nitrogen originally contained in the mixture, or that liberated by the combustion. This calculation shows that the nitrogen = 0·01, from which we conclude that the gas from coal, distilled and collected as we have described, does not contain in appreciable quantity nitrogen, cyanogen, or any other nitrogenous substance. Hence it follows that the gaseous mixture must contain, in addition to the hydrocarbons already mentioned, others of unknown composition. It was now quite necessary to ascertain positively whether perchloride of antimony completely effected the separation of the latter as well as of olefiant gas. This question is easily decided by conducting coal-gas, freed from carbonic acid and sulphuretted hydrogen, through a Liebig's potash tube containing perchloride of antimony, behind which is placed another containing potash, for the

purpose of arresting the volatile perchloride, and a tube filled with chloride of calcium, to prevent the escape of aqueous vapor. The gas treated in this way is collected over mercury, and exploded with the necessary quantity of oxygen, which is determined, as well as that of the carbonic acid generated; and the proportion of the latter to the amount of aqueous vapor produced is obtained by leading another portion of the gas over red-hot oxide of copper. With this knowledge we possess all the data for estimating the amount of light carburetted hydrogen, carbonic oxide, and hydrogen, not only by the formulæ 1, 2, 3, but also by those afterwards described (4, 5, 6, 7) for calculating the quantities of light carburetted hydrogen, carbonic oxide, olefiant gas, and hydrogen contained in a mixture. When both these calculations agree, and when we obtain by the last of them *c* as the value of the olefiant gas, this result may be viewed as a certain proof of the complete retention of the olefiant gas, and other hydrocarbons of unknown composition, by the perchloride of antimony, without any change in the other gases. An experiment instituted for this purpose gave the following result:—

	Volume.	Temp. Cent.	Pressure.	1 m. at 0°.
		°		
Gas used,	155·4	— 4·3	0·4497	71·00
After admission of O,	343·4	— 4·3	0·6351	221·57
After combustion,	197·6	— 4·3	0·4872	97·81
After absorption of CO_2,	122·8	— 3·7	0·4109	51·15
After admission of H,	330·3	— 3·7	0·6171	206.62
After combustion,	130·7	— 3·7	0·4041	53·53

The relation of aqueous vapor to carbonic acid 0·2035 grm. : 0·2113 grm. The values deduced for calculation are—

$$\frac{D}{E} = 2{\cdot}3488,$$

$$A = 70{\cdot}8800,$$

$$B = 99{\cdot}5400,$$

$$C = 46{\cdot}6600.$$

The formulæ 1, 2, 3, give us the composition,—

Hydrogen,	24·22
Light carburetted hydrogen,	42·73
Carbonic oxide,	3·93
Nitrogen,	0·12

The formulæ 4, 5, 6, 7, give on the other hand,—

Hydrogen,	24·50
Light carburetted hydrogen,	42·27
Carbonic oxide,	3·83
Nitrogen,	0·12
Olefiant gas,	+0·28

The agreement of these results may be considered as a proof of the ap-

plicability of perchloride of antimony for our purposes, as the differences are quite within the errors of observation, and as similar differences might arise by a variation from unity in the third decimal of the expression $\frac{D}{E}$. But to remove every possible doubt as to the accuracy of our results, we have taken the specific gravity of the mixture of gases treated with perchloride of antimony, and compared this result with the theoretical density as calculated from the known composition.

In estimating the specific gravity, it was of importance to operate upon a smaller volume of gas than usual, because it was necessary to have the same gas collected over mercury, not only in the combustion with oxide of copper, and in the eudiometric analysis, but also in taking the density of the gas. We have, therefore, used in our experiments a plan somewhat deviating from that usually adopted, and which, for simplicity and accuracy, merits to be followed in other cases. The vessel used for weighing the gas consisted of a flask, such as that used for digestion, and of a capacity of 200 cubic centimetres; the neck of this flask was drawn out before the blowpipe until the opening was narrowed to the thickness of a straw, and was then supplied with a well-fitted ground glass stopper.—This flask, the capacity of which had been previously accurately determined, was filled with mercury, with the precautions already described, (page 275,) and the gas to be weighed was then introduced, leaving, however, the mercury still in the vessel, to the height of one or two-tenths of an inch. The apparatus, with its mouth placed under mercury, is placed as vertically as possible, and allowed to acquire a uniform temperature. When this has taken place the stopper is introduced, and by means of an etched graduation on the neck, the height of the mercury over the level of that in the trough is accurately noted, in order to deduct this from the column of mercury in the barometer observed at the same time. The flask, removed from the trough, and carefully cleaned on the outside, is then weighed, with all the necessary data for corrections employed in such cases, after which it is filled with dry air, care being taken that none of its liquid contents are lost in doing so; and then it is again weighed. An experiment made in this way with gas purified by perchloride of antimony, gave the following result:—

Volume of the gas weighed at 9° C. and 0·7337 pressure, 211·05 cubic centimetres.

Weight of the flask filled with gas at 9°·9 C. and 0·7557 pressure, 49·0262 grms.

Weight of the flask filled with air at — 3°·5 C. and 0·7557 pressure, 49·1920 grms.

The specific gravity, 0·4073, which results from this experiment, does not differ from 0·41, the density calculated from the above analysis, more than we might expect, from the possibility of error of observation in such experiments.

The experiments now detailed prove that other hydrocarbons must be present, besides olefiant gas and light carburetted hydrogen, but they do not show whether olefiant gas itself is contained in the mixture. Its presence is, however, easily shown, by the circumstance that the perchloride

of antimony used in the absorption yields, by distillation with water, chloride of elayle with all its characteristic properties.

When a stream of gas, obtained by the distillation of coal, is conducted through a Liebig's tube filled with a solution of oxide of lead in potash, a precipitate falls, consisting of sulphuret and carbonate of lead: sulphuretted hydrogen and carbonic acid gases are, therefore, constituents of the mixture. But there is not a trace of the vapors of sulphuret of carbon in the gas, for the gas thus purified does not in the least degree smell of sulphuret of carbon, being in fact quite destitute of smell.

The gases evolved from iron furnaces must contain nitrogen, in addition to those described, for this gas enters with the air supplied by the blast. The preceding investigations show us that the gases from furnaces contain the following constituents:—

1. Nitrogen.
2. Ammonia.
3. Carbonic acid.
4. Carbonic oxide.
5. Light carburetted hydrogen.
6. Olefiant gas.
7. Carburetted hydrogen, of unknown composition.
8. Hydrogen.
9. Sulphuretted hydrogen.
10. Aqueous vapor.

(To be Continued.)

From the Boston Daily Evening Traveler, of March 10, 1849.

Report on the Explosion of the Locomotive Engine "Taghconic," on the Boston and Providence Railroad.

Read before the Boston Society of Civil Engineers, March 6, 1849.

The undersigned, appointed at the last session of the Society, to investigate the matter of the recent explosion of a locomotive engine on the Boston and Providence Railroad, respectfully submits the following report:

This locomotive engine (one of the largest class now used) started from the Providence station with the passenger train from New York, via Stonington, on the 1st of February. The engineman was Mr. Lucius Cummings, who is represented, by those acquainted with him, to have been a very competent and steady man. He had been in the service of the Boston and Providence Railroad Company about ten years, and for the last seven years had been in the charge of a locomotive engine.

The train proceeded on in the usual course from Providence to the station at Mansfield, ten miles from the point where the explosion took place. At this place it passed the freight train. The only fact having any bearing upon the accident up to this time, was the remark of the engineman of the freight train, that the "Taghconic" was blowing off steam freely when she passed him at this place.

From Mansfield station, the narrative of George Lingham, the fireman, was taken for the statement of facts relative to the running and appearance of the engine, which was as follows, (substituting distances for points on the road noted by him.)

"At Mansfield we stopped and took in wood and water; tried the upper gauge cock and found water and steam; safety valves blowing off. We started from Mansfield with one pump on; 1600 feet from the starting point, filled the furnace with wood; 13,000 feet, filled the furnace again. From this point we ran a distance of about 10,000 feet to the summit, where the throttle was shut off to less than half its opening, and the furnace door was opened. Thence about 4000 feet, where a few sticks of wood (four or five) were thrown into the furnace. Thence 1500 feet to the top of the inclined plane; where the throttle valve was entirely shut, and both pumps put on, and the furnace door shut. At a distance of about 8000 feet the pumps were tried; they worked water. Thence 7500 feet, and the gauge cocks were tried; the upper cock showed water. The engineer took down his lantern at this time, and examined the flow of water carefully; remarked that he had never seen the pumps work better, and told me to shut off both pumps, which was done, as he remarked we should get a strike when we got on the bridge; meaning that when the steam was again let into the cylinders, the water would be thrown over into them, on account of its being so high in the boiler. I asked Mr. Cummings if I should fire up. He replied, No; that he wished to run easy, as the night was dark and we were about running through the switch, at the part of the road where the Stoughton branch leaves the main track. I did not fire up. We ran on this way 5500 feet, to the viaduct, where the explosion took place.

"At the moment of the explosion I was in a stooping position, moving a piece of wood in the way of the break, which I about to use. I recollect Mr. Cummings reaching up to the cord connecting with the steam whistle when the explosion took place. I cannot recollect having heard the whistle. When I recovered after the explosion, I called for the Engineer, but he had been killed instantly by the explosion; my life was saved by being in the stooping position before mentioned. I put down the break and stopped the engine. My clothes were wet somewhat, but probably from the water from the tank in the tender. I was not scalded, but my face was burned. I saw no indication of hot water having been thrown on to Mr. Cummings; he was not scalded.

"There was very little fire in the furnace after the explosion; it was put out with water. I cannot tell how long after the explosion it was put out."

The explosion took place about 5¼ A. M., February 1st.

Description of the Engine.

This was one of the largest class engines, built by the Boston and Providence road at their shop, and was put upon the road in January, 1848; so that, consequently, it had been at work about one year at the time of the accident.

The boiler was one of the usual form, consisting of a fire box and cylindrical boiler; the heat being conveyed through the boiler into the smoke arch by a number of tubes.

The following are the principal dimensions of the boiler:

Diameter of the waist or cylinder outside, 40 inches.

Number of tubes 135; made of copper brazed.

Size of the tubes $1\frac{9}{16}$ inches inside diameter; $1\frac{3}{8}$ inches outside diameter.

The space between the tubes and the lower part of the boiler, 0·150 of a foot.

Whole height of the upper row of tubes above the bottom of the boiler, 1·515 feet.

The size of the furnace inside, 3·05 feet in length—the water spaces between the two plates making the fire box 2 inches, or 0·18 ft.

Length of tubes, 10 feet.

The height of the crown of the fire box above the level of the tubes, 0·27 of a foot to the under side of the bridge bars, which were 0·19 of a foot deep—wrought iron.

The thickness of the iron plates constituting the shell of the boiler, was, for the part forming the casing of the furnace, $\frac{3}{8}$ of an inch thick; for the cylindrical part, $\frac{5}{16}$ of an inch thick, made of Pennsylvania iron, Lukin's brand.

The boiler was well stayed between the shells of the furnace; and longitudinally between the heads of the boiler there were six long stay bolts, and also four shorter ones, which were attached to the head of the boiler at one end, and the other bolted to the top plate of the arch.

The boiler was provided with two safety valves of the capacity of $2\frac{1}{2}$ inches diameter, loaded to a pressure of about 90 pounds to the square inch. The gauge cocks were on the front side of the furnace, a little to the right hand of the furnace door.

The outside of the boiler was covered by a casing of pine wood, which was also covered with a casing of sheet iron.

The committee of engine builders who examined the engine, report, February 7th, that "the construction of the boiler was substantially that which is common to other locomotive boilers, and its material, workmanship, and proportions, were all sufficiently good."

A steam brake was attached to the top of the boiler, which was carried away; but there is no probability that this had anything to do with the explosion, unless the mode of fastening it to the boiler may have weakened the plate, which there is no reason for believing to have been the case. It is mentioned here, only that all the circumstances may be recorded for future reference.

Description of the Boiler after the Explosion, made February 10th, 1849.

This examination was made ten days after the disaster occurred. The engine had been removed to the repair shop, part of the wreck cleared away, and part of the tubes had been removed; otherwise it was in the same state as it was immediately after the accident.

The explosion had apparently torn off the whole top of the boiler over the furnace, between the waist of the boiler and the front plate of the furnace, down to the level of the frame of the engine. The fracture was irregular; in some cases following the line of rivets, in others giving way between the line of rivets at the angle where it joined the waist, and in other parts leaving a width of 3 or 4 inches attached to the boiler, where the parts were joined, or tearing off 3 or 4 inches inside of the lap.

Some parts of the iron were apparently broken, in other parts evidently torn apart. The front plate was entire, bent outwards to some extent, and two of the long stay bolts broken off. All the short stay bolts were

drawn from their connexion with the other parts, throughout the whole extent of the fracture.

The whole body of the boiler at the furnace end was bent downwards, and bore upon the shaft of the engine.

The crown of the fire box slightly bent downwards, but no visible fracture of the parts.

The whole of that part of the engine and machinery over the fire box was fractured, and the most part carried away.

The forward part, though deranged by the accident, being twisted and dislocated, did not indicate that any part of the boiler, or other parts removed, took that direction, but that the explosion was upwards, and backwards from the direction in which the train was moving.

The boiler showed every indication that, either before or after the explosion, it had been subjected to a great heat.

Some parts of the iron showed evident marks of heat; the tubes in the middle and lower part were scaled by the heat, and the brazing or solder in the joints to some extent melted out. The tubes of the upper row, and those at the sides, did not show that they had been heated more than is usual in the working of an engine.

The wooden casing of the boiler was charred through its whole extent, to a depth of $\frac{8}{10}$ths of an inch thickness, and at the joints of the plates it was entirely burnt to a coal. The sheet iron, which covered the wooden casing, was discolored in a small degree in one or two spots; otherwise it did not show any effect of heat.

The inside of the boiler and the outside of the tubes were covered with the usual incrustation found in steam boilers, in all places where the heat had not scaled it off.

One of the safety valves remained in place at time of the examination; the other was gone, and the lever broken and bent by the explosion.

The appearance of the pumps, when the engine was taken apart for the purpose of repairing it, showed no indication that they had been out of order.

The grades of the road over which this engine was working are as follows:—

From Mansfield.

3,000	feet,	18 feet per mile ascending.
1,300	"	24 " " "
21,700	"	10½ to 22 feet per mile ascending.
5,900	"	Level—Summit.
20,900	"	descending 35 to 40 feet per mile, to the point where the explosion took place.

Thus it appears that, after leaving the station at Mansfield, the engine worked for a distance of about 5 miles, up an ascending grade of different inclinations, varying from 10½ to 24 feet per mile; then over a level of one mile; then on a down grade of 35 to 40 feet per mile, 4 miles, to the point were the accident happened.

The wind at the time was N. E., and a snow storm commencing.

Having made this statement of facts, it might be proper, under most circumstances, that your committee should stop here; but as the actual in-

vestigation of a subject gives an advantage in the thorough understanding of the whole subject matter, which the reading of a recital of facts will not generally give, we shall venture to trespass upon your indulgence, to again recite some of the most prominent facts connected with this disaster, and submit such comparisons and conclusions as we have been able to make, in order that, as far as in us lies, we may do our part to prevent, if possible, the recurrence of a similar accident.

The appearance of the boiler after the explosion, shows that the shell and part of the tubes had been subjected to an intense heat, and also that water had been suddenly applied to the surface of the tubes;—the evidence of this last fact is the appearance of the copper. This appearance can be produced only by heating to nearly a red heat, and then plunging it suddenly into water.

The explosion appeared to follow immediately upon opening the steam whistle, as the man at the station says that he heard the sound of the whistle and the report of the explosion, as it were, at the same moment of time.

An apparently obvious solution of the problem at once presents itself:

1st. That the water was low in the boiler.

2d. That the whole interior of it was heated to a high temperature.

3d. That opening the steam whistle caused the water to rise immediately, to come into contact with the heated tubes and sides of the boiler, thus producing a volume of highly elastic steam, which the boiler could not resist.

But this solution will not satisfy the conditions of all the evidence.

It is conceded by all persons having competent knowledge of the matter, who have been seen by your committee, that Mr. Cummings, who had charge of the engine, was an experienced and competent man, not liable to be deceived by the foaming of the engine, and, least of all, to be deceived by his pumps.

The testimony of the fireman also proves that all the time, from leaving Mansfield up to almost the instant of the explosion, one pump was in action, and that part of the time two pumps were on; that the pet cocks were tried once at least, and that they indicated full action of the pumps. This being the case, the injection into the boiler must have been going on in the usual manner. Added to which is the consideration, that the engine man, after a careful examination of his gauge cocks and his pumps, ordered them to be shut off, because he feared his boiler would be too full of water.

Another proof that the water was not nearly all out of the boiler, is the fact that the tubes were not generally burned, the heated appearance being confined to the middle of the mass of tubes, the outside and top of the mass showing no indication of undue heat. A specimen of one of these tubes is presented. It shows the usual appearance of tubes in an engine properly worked; even the particles of carbon on the inside, usually found in them, are remaining, and it seems impossible, from this testimony, to believe that these tubes had been uncovered by the water.

The received opinion at present is, that boilers are either burst by crowding upon them too great a pressure of steam while working, or by allowing the water to leave the parts of the boiler exposed to heat, and afterwards suddenly throwing the water upon these heated parts, either by injection

of cold water, or by altering the position of the boiler, (as in steamboats,) or by a sudden foaming or ebullition of the contained water, by opening some of the apertures in the boiler. The present case under consideration has but one of these circumstances attached to it, to wit: opening the steam whistle; which would occasion ebullition or foaming. The previous condition of want of water is not supported by the evidence;—but the whole of the testimony, both of living witnesses and the appearance of the boiler itself, is opposed to this position.

We can, therefore, assume that this accident was occasioned by an excessive pressure of steam, greater than the resistance of the shell of the boiler. From whence came this excessive pressure? As the testimony before recorded is not reconcileable with the supposition that the boiler was insufficiently supplied with water, your committee was induced to seek further for a solution of the problem, in examining the recorded cases of explosion, and different papers written in this and other countries, upon the subject of the explosion of steam boilers.

In most of these cases a direct cause has been assigned for the result, either from bad pumps or actual or supposed defect in the safety valves.

Some of the most prominent cases are noted for the purpose of reference, for those members of the Society who may wish to examine further into the subject, and a note is subjoined for that purpose, rather than to swell this report with extracts from them.

It will be seen that all the locomotive engines have burst downwards, with great loss of life and injury to property. This case is different, the explosion being upwards. In some of the other cases of tubular boilers the outside shell has given way, mostly from an evident weakness in the plates.

In the course of this examination, a theory but little known in this country, but one evidently much considered in Europe, seemed to your committee to meet the conditions of this case more fully than any other, and induced a further examination and comparison of the evidence. It is now presented solely for consideration, without taking the ground that it was actually the cause, but that there is strong probability that it may have been.

The theory alluded to is the property of repulsion noticed in fluids, when placed in vessels heated above the point of maximum evaporation. This property has been quite fully investigated by Klaproth, Boutigny, Perkins, and by the Committee of the Franklin Institute, and others.

A very interesting and instructive paper upon this subject, by J. E. Bowman, Esq., read before the Royal Manchester Institution, February 17th, 1845, is recorded in the Journal of the Franklin Institute, Vol. 36, (1845,) pages 182 and 268.

As the conclusion of that paper seems to afford a proper solution in this case, we take the liberty of making an extract from it.

After reciting the different experiments, he says:

"If water be now gradually thrown into an over-heated boiler, we know, from what has already been said, that it will pass into a spheroidal state, and will continue at 205° of temperature until, from some cause or other, it is permitted to come in contact with the heated surface, when violent ebullition immediately takes place, an enormous quantity of steam is in-

stantly produced, and if the vessel be a closed one, as is the case with steam boilers, an explosion is the almost inevitable result.

"The water, on ceasing to be spheroidal, wets or comes in contact with the heated vessel, and is converted instantly into steam, which being thus generated in a vast quantity, finds an outlet at the point of least resistance.

"This experiment proves that if water exists in the spheroidal state in a boiler, and the boiler be allowed to cool, owing to the extinction of the fire, an explosion is the almost certain consequence.

"A result precisely similar is produced by adding a quantity of cold water to a boiler containing a portion of the liquid in a spheroidal form.

"But here the question arises: Does water ever become spheroidal in steam boilers? And if it does, what are the circumstances which lead to such a dangerous crisis?

"That water contained in boilers does pass into the spheroidal state there can be no doubt. * * * * * * It has actually been seen to be so. What then are the causes which lead to the occurrence?

"The most obvious cause is deficiency of water in the boiler, owing either to the negligence of the engineman, or to some defect in the feed pipe. When this deficiency occurs, the boiler (if the furnace be in action) shortly becomes highly heated, and it is by no means an uncommon occurrence for it to reach even a red heat. If water, under these circumstances, be thrown in, the first portion becomes of course spheroidal, and continues so until, by an introduction of a sufficient quantity, the boiler be so far cooled as to be unable to maintain the spheroidal form of the water. No sooner is this the case, than the spheroid comes in contact suddenly with the overheated boiler, bursts into steam, and in all probability an explosion is the result."

Another and highly probable cause of water becoming spheroidal is the incrustation of non-conducting substances on the interior surface of the boiler.

From the same paper quoted above, we have the opinion expressed that, "There can be no doubt that a part of the boiler occasionally becomes nearly red-hot, although this condition appears inconsistent with the supposition that it is at the same time covered with water. Yet we have been compelled to adopt this conclusion, from having had occular demonstration of its possibility.

"The probability of boilers sometimes approaching a red heat, receives a corroborative proof on examination of the iron plates in cases where the boilers have bulged out, and which exhibit an appearance well known to boiler-makers, by a peculiar color in the iron surrounding the part which has been red-hot.

"We may conclude that the principal cause of boilers becoming unduly heated, is undoubtedly, in a majority of cases, owing to the interposition of indurated iron conducting matter between the heated metal and the water."

This indurated matter is liable to be occasionally thrown off from the surface of the metal, in which case the water comes suddenly upon the heated surface, and is repelled by it to a certain degree. Should it be but a small surface thus suddenly exposed, the danger of explosion will be small, but the principle will be the same, and the danger of explosion will be in proportion to the surface of metal thus deprived of its coating of non-conducting matter.

That the contained water in all steam boilers may at times (suitable circumstances concurring) assume this spheroidal form, to a greater or less degree, is, we think, beyond question.

We assume, therefore, that the spheroidal theory is a true theory, and also that it will explain and conform to all the testimony collected in this matter, which the common theory (before mentioned and examined) will not do; and by no other theory as yet advanced by persons who have had competent advantages for examination, can this be done.

First, All the testimony goes to prove, as strongly as we can ever expect such a fact can be proved, that the boiler was well supplied with water; that the upper and outside tubes were not exposed to the action of great or unusual heat, is proved by their appearance. That the tubes at the bottom and middle of the mass were exposed to great heat, is also proved in the same manner.

How could these tubes be burned, and those which would be the first uncovered escape, if the explosion was occasioned by the water being low?

The only possible explanation for this, would be the supposition that the tubes and outside casing of the boiler were exposed to the great heat which their appearance indicates, by the fire remaining in the furnace after the explosion took place; and that those tubes which escaped had at that time no circulation through them.

But the evidence, so far as it goes, shows that the fire was low at the time, and that but a short time elapsed before the fire was put out, and after the explosion, the shell of the boiler, which was so much burned, was exposed to a circulation of air on all sides. It is to be regretted that more precise information cannot be had on this point; but the fact that the upper rows of the tubes escaped the extreme heat which the others indicate, seems to prove conclusively that the water could not have been at any time below them, so as to leave them uncovered; also those burned were subjected to the action of water after they were heated, which could not be done if heated after the explosion. This and the other reasons, which, from the testimony, are opposed to the presumption that the water was low, carry us unavoidably to the conclusion that the difficulty was local, and beneath the ordinary level of the water, and was occasioned by the undue heating of the lower and middle portion of the tubes, thus giving the contained water the spheroidal form before alluded to.

The fire, as appears from the evidence, was low, and gradually falling lower, at the time of the explosion; in this respect conforming to the principles of the spheroidal theory, that an explosion will take place as the temperature is reduced.

The opening of the aperture connected with the steam whistle, undoubtedly hastened the catastrophe; but may very readily be accounted for upon the hypothesis, that a slight agitation of the water would reduce the spheroid form of the water into highly explosive steam.

The causes which combine to produce this spheroidal form, their combinations and degrees, yet remain to be demonstrated; but it is considered that, in all reasonable probability, this is at least one instance of explosion from this form; and that it may induce others to collect and arrange the facts as they arise, is one reason that we have been induced to go so much into the detail of the matter.

That they may and will occur with locomotive engines of the present construction is probable, as the passages for the water between the tubes are so small and so liable to collect incrustations of matter from the water used.

The most obvious remedies for this difficulty which have been collected during the investigation, are to keep the boilers as free from deposite of non-conducting matter as possible.

To increase, as far as practicable, the size of the water spaces between the tubes, and the use of fusible plugs in the boiler, to indicate an undue heating of any part.

And also to provide some better arrangement for ascertaining the height and condition of water in the boiler.

In conclusion, your committee would take this occasion to acknowledge their obligation to W. R. Lee, Esq., General Superintendent, Mr. Griggs, the Superintendent of the Locomotive Department, and other officers and men connected with the Boston and Providence Railroad, for their attention and desire to give all the information at their command.

WILLIAM P. PARROTT, *Com.*

Boston, March 6, 1849.

From the Pittsburg Journal, April 2, 1849.

Report of the Explosion of a Steam Boiler in Allegheny City, Pennsylvania.

PITTSBURG, *March* 29, 1849.

THOMAS BAKEWELL, ESQ., *President of the Board of Trade.*

DEAR SIR:—The Committee appointed by you on the 27th instant, to inquire into the cause or causes which led to the late fatal explosion of a steam boiler in Allegheny City, would ask leave to submit the following

REPORT:

That they have visited the premises, and made their own observations; but not having authority to take depositions under oath, they have made inquiries of those whom they could find, who would be most likely to know the facts in the case. Among these were Mr. Andrew Fife, one of the owners, and who was running the engine at the time of the explosion; Mr. David Fife, who, we believe, was also one of the owners, and in the factory at the time; and J. Rush, Esq., Mayor of Allegheny, who occupied the adjoining building with woollen machinery, and his son, who was in the building at the time, and several others, who were early on the ground or had good opportunities of knowing some of the particulars. And from all the information which your Committee have been able to collect, they believe the facts in the case are as follows, viz:

The boiler which exploded was thirty-six inches in diameter, and eighteen and a half feet long, without flues. The shell, or cylindrical part, was made of three-sixteenth iron, and the heads of cast iron, one and an eighth and one and three-sixteenths of an inch thick; the supply in the back end, near the bottom; the steam pipe and safety valve on the top, near the front; the man plate in the front, near the front; and three gauge cocks in the

front, the lower one of which was at the centre of the boiler, or in a horizontal line across the centre—the other two above it. The boiler supplied an engine, the cylinder of which is six inches bore and thirty inches stroke, which propelled cotton machinery in the building in which it stood, belonging to the Messrs. Fife, and woollen machinery in the adjoining building, belonging to J. Rush, Esq.

The engineer says that the explosion occurred about 11 o'clock, A. M.; that the engine was running as usual; that he had just tried the middle cock, and found water as usual; and had just turned to go out of the door, for coal, when he felt himself forced forward, and the house falling down about him.

It appears that the back head of the boiler was forced out, all at once, leaving the flanch or rim of the head, riveted to the end of the boiler, as it was; the head went directly back some thirty feet, carrying with it the entire bottom of the brick chimney, (which stood directly back of the boiler,) causing the whole of the chimney to come down, and perhaps topple forward upon the top of the house, which came down at the same time but partly owing, perhaps, to the back wall of the house being forced out by the lateral pressure of the steam which issued from the back end of the boiler as it passed forward; the boiler having been in the lower story of the house, parallel with and against the back wall. When the back head of the boiler gave way, the back end being entirely relieved, while the pressure continued against the front head as usual, the boiler was of course carried forward, passing through the two end walls (which were of stone) of the adjoining woollen factory, and raking the back wall of the same, tearing it down its whole length, (about twenty feet,) and landed in the next yard, where it now lies. Had not the front head been demolished, by battering down the stone walls, it would have continued its course on through a frame house, and gone out into the East Commons. But as soon as the front head was destroyed; the weight of steam within it was soon neutralized, and the boiler continued only by the momentum which it had received, in the short time which elapsed between the giving out of the back head and the battering in of the front head, the front stone wall having been only five feet from the front of the boiler.

The boiler in question was made some nine months ago, with wrought iron heads and two flues, as is usual with river boilers, and put with another on a small steamboat, where it exploded about three months afterwards. It was then taken ashore the flues and heads taken out, two new cast iron heads and two new rings of boiler iron put in, and then put up as before described. No effect, however, of the former explosion remained with the boiler, nor has any part given way which was then in the boiler; the whole boiler, indeed, is of good material and workmanship, and had no fault except that of being *too light*, especially in the heads, for the enormous weight which was crowded upon it.

Two of the most important facts in the case of this explosion your Committee have not been able to ascertain with certainty; that is, the amount of weight on the safety valve, and the supply of water in the boiler; the very explosion itself almost necessarily destroying all evidence in the case, leaving us, as usual in such cases, to conjecture upon such citcumstantial evidence as might be found.

The engineer doubtless thought there was water at the second cock, as he had just tried it; but far more experienced engineers have been deceived by a *show* of water at first, where repeated trials, or holding the gauge open for some time, may show only blue steam.

The boiler has the appearance of having been highly heated, but whether it was before or after it was moved out of its place, your Committee are somewhat divided in opinion. It is not necessary, however, in accounting for the explosion in this case, to suppose a scarcity of water, as there is sufficient cause without.

It appears that machinery had been added on, in various parts of the establishments, until the engine was fairly overloaded, and a gradual increase of steam raised until the back head yielded, which was of itself sufficient to produce the result as we found it, without supposing the existence of any combustible or explosive gas, which may or may not occur in similar cases, but which, we think, did not in this.

As to the amount of weight on the safety valve, the Committee are quite uncertain. The persons who put up and attended the engine, said they were carrying about sixty pounds to the inch, but perhaps, like most persons in that employment, had never made an accurate calculation, to be certain whether it was so or not.

We found two safety weights lying together with the safety valve, lever, chamber, and fixtures, but neither of them on the lever, but both of them *had* been on when the engine was in use in another place; and your Committee are strongly inclined to the belief, from all the testimony and circumstances in the case, that they were both on at the time of the explosion, although this is not admitted by some who ought to know. One of these weights was 38¼ lbs.; and the other 21½ lbs.; the safety valve is two inches diameter *scant*, or about three square inches area; the last notch in the lever is ten times the distance of the fulcrum; the lever we did not weigh in position, but suppose it would require thirty pounds to raise it. The engineer said he had the small weight in the last notch; but finally admitted he had a large boiler wrench, which he supposed weighed about ten pounds, hung on at the same place. This would require the pressure of steam inside to be 116 lbs. per square inch over the pressure of the atmosphere, before the valve would raise, even taking his own statement of the facts. But if we add the other weight, which was found with the rest, and which some say they have seen on lately, and allowing that to hang at the middle of the lever, it would add 64 lbs. per inch, or 180 lbs. per inch in all; or if it hung in the notch next the small weight and wrench, it would have made the whole weight 230 lbs. per inch. But take the engineer's statement, which gives 116 lbs. pressure per inch, we would consider it rather unsafe for many of our land boilers in use about the cities, and entirely unsafe for this one, without *double* that pressure, which was probably the fact.

It is a custom (much to be regretted) among beginners, manufacturing on a small scale about our cities, to commence with cheap and light boilers and machinery, and inexperienced engineers, seeming to think that such temporary arrangements may do for so small a business, and that when they have become able to extend, they will make things more permanent and secure.

Alas! many of them never see that day from this very cause. The last three explosions which we have had were all of this kind; and in each of two of the cases, one of the owners, one of the families, and several in employ, were killed. We would also remind our numerous manufacturers who are doing business on a more extensive scale, that all the explosions which have occurred about our cities have been similar to this: that is, the cast iron head has been torn from the rim, the crack commencing in the inner angle; being occasioned first by inclining to draw off from the rim in cooling, when cast, and continued by springing the centre of the head out by the pressure of steam, and relaxing when steam was down, which daily vibrations, in course of time, deepen the fracture and weaken the head.

All boiler heads made here in former years, were too light for the pressure of steam now generally used; many of them have been replaced, and many more, no doubt, ought to be, with new and strong ones.

Our government now requires boiler heads, even for thirty-inch boilers, to be one and a half inches thick.

Your Committee would also even caution our fellow-craft, not to furnish boilers of a light or temporary kind, although the owners may volunteer to assume all responsibility.

In conclusion, your Committee would further recommend to the Board of Trade to use their influence at the proper time, with the proper authorities, to have such laws or jurisdiction extended over all land engines, as now applies to our marine engines.

Respectfully,

W. J. Totten,
Wm. P. Eichbaum,
Wm. McClelland,
Wm. Barnhill,
} *Committee.*

Notice of the Explosion of the Steamer Virginia.

From the Pittsburg Journal, April 2, 1849.

By the politeness of the clerk of the steamer Zachary Taylor, we are furnished with a list of the killed, wounded, and missing, by the explosion of the boilers on board the steamer Virginia. She was employed as a regular packet between Wheeling and Steubenville, and, at the time of the accident, had landed to put off a passenger at Rush Run. The explosion occurred immediately on attempting to start the boat on her course.

The Zachary Taylor was on her way from this city to Wheeling, and was at the scene of the catastrophe in a few minutes after it occurred, and rendered every assistance in her power to the wounded. The officers are deserving of commendation for their efficient aid to the sufferers.

The boat was literally blown to fragments, and, of course, is a total loss.

Killed,	10
Wounded,	10
Scalded,	3
Missing,	1

The cause of the accident—whether from defective boilers or from care-

lessness on the part of the engineer,—has not yet been ascertained. Accidents of this nature are becoming lamentably frequent of late.

The Virginia is represented as having been a small boat, but the opening of the spring business gave her a large passenger list. Her freight will be a heavy loss to small dealers.

Results of the Telegraphic Operations of the United States Coast Survey.

From the Proceedings of the American Philosophical Society, March 16, 1849.

Dr. Patterson, in the name of Prof. A. D. Bache, laid before the Society an abstract of a report, made by Mr. Sears C. Walker, of the results of the telegraphic operations of the U. S. Coast Survey, made by him on the 23d January last, between Washington and Philadelphia, New York and Cambridge, Mass. A letter from Prof. Bache to Dr. Patterson, accompanying the report, was read by Prof. Kendall.

Washington, March 1, 1849.

Dear Sir,—Will you please communicate to the American Philosophical Society a brief abstract of a Report made to me on the 21st ultimo, of the results of the Telegraph operations of the U. S. Coast Survey, made on the 23d of January last, between Washington, Philadelphia, New York, and Cambridge, Mass., by Mr. Sears C. Walker, assistant, having charge of the Telegraph operations.

The object in view was to test the practical working of the method of imprinting the dates of star transits on a graduated clock register. The three astronomical stations selected for the occasion, were the Philadelphia Observatory, under the direction of Prof. Kendall; the New York City station, in the private residence of Dr. L. M. Rutherford, under Prof. E. Loomis; and the Harvard Observatory, Cambridge, under Prof. Wm. Cranch Bond.

In conformity with the plan of his Report of December 15, 1848, duplicate records were kept at the Washington Northern Telegraph office, by Mr. Walker and myself.

The astronomical clock was located at Philadelphia, and rated for several days by Prof. Kendall. It contained two tilt-hammer *electrotomes*, one invented by Mr. J. J. Speed, Jr., of Ithaca, N. Y., in 1847, attached to the minute wheel, and giving its signals every two and a half minutes. The other (used for the occasion) was on the plan invented by Dr. Locke, in 1848, and attached to the escapement-wheel. The automatic clock register was graduated to two seconds, usually occupying an inch of paper of the Morse's registering fillet.

Mr. Walker reports that a comparison of sixty records, made by the two registers at Washington, shows that the probable error of the mechanical operation of printing and reading off, is only about fifteen-thousandths of a second.

This confirms the estimate of accuracy of the work, made by him in his report of Dec. 15th last, viz., of a hundredth of a second for the case of an automatic register of single seconds, with an inch of paper to each.

It further appears from the Report, that when the star-signals were given

at Philadelphia, so that the clock and signal waves had the same local origin, all the registers at all the stations marked alike, within such limits as were indicated by the probable error just mentioned.

When, however, the star-signals were given at New York, small, but appreciable, differences were noticed in the respective readings of the apparent date of the same event, as recorded at the different stations. This discrepancy was still greater for the case of the Cambridge star-signals, the graduating clock remaining always at Philadelphia.

The following table contains the mean excess of the readings of the date of each event, in the time of the Philadelphia automatic clock, at each station, over that of each of the others, with the number of single results, and the probable accidental error from the source already referred to.—The stations compared are denoted by their initials. Those marked *W*, are for the mean of the two records made at Washington. A further revision of these quantities may somewhat change their amounts.

Two kinds of readings were made, viz., *break circuit* signal readings on a *break circuit clock scale*, and *make circuit* signal readings on a *make circuit clock scale*.

The excesses indicated by the mean of the two series of readings for the two scales, with the number of results and probable error of each, are reported as follows: The times A, B, C, and D, respectively denote the time of passage of the galvanic wave between W and P, P and N, N and C, C and W.

For reasons connected with the analytical theory of longitudes, by Telegraph operations, as published in Mr. Walker's report of Nov. 10, 1847, and in the recent report of the 21st ultimo, the mean of the two series is the most plausible value that can be derived from the printed record. The residual quantities do not appear to be explicable by any admissible value of relative times of operations, of the spiral spring and receiving magnet, armature. Neither do they appear to be explained by any reasonable hypothesis of relative changes of apparent dates from changes of permanent magnetism, as it is called, by change of locality of signal station. The analytical theory of this subject was given by Mr. Walker, Dec. 28, 1847, in his Report on the Telegraph operations of 1847.

These several sources of error are nearly all eliminated by the manner of forming the residuals of these tables, and being in their nature periodical, disappear in the average of all the results. It may also be remarked, that the outward and inward armature times of the magnets of the local registers, are relatively annulled by their having the same value for the clock and signal electrotomes.

According to Mr. Walker's report, these residual quantities, from change of relative place of origin of the clock and signal waves, may all be explained by the hypothesis that the time of propagation of the galvanic wave from the place of the clock or star-signal stations, to that of the receiving register, though small, is not quite insensible. A solution of the eighteen equations of condition formed on this hypothesis, by Mr. Walker, give, for *the velocity of the propogation of the galvanic wave, through the compound circuit, eighteen thousand eight hundred miles per second*, with a probable *accidental* error, as stated by him, of about one thousand miles. The statistics are too incomplete to warrant any discrimination between

the times of propagation of the wave through the different kinds of media, viz., the wires, the batteries, (three in number,) and the ground. After applying the values of the wave-times by this hypothesis, and with this velocity in the different portions of the whole circuit of one thousand and fifty miles, no sensible discrepancy remains, the residual terms being not greater than their probable errors, from the comparison of the two Washington registers. All the readings now harmonize as well as if all the clock and star signals, and all the printed records, had been made in the same place.

The result is one of much interest to the progress of science, and of special importance in the longitude operations of the Coast Survey.

The value apparently attributable to wave time, is too great to be neglected in telegraph operations for longitudes intended to be used as data in connexion with geodetical measurements. A more extensive series of operations, with more complete mechanical arrangements, will be undertaken in the course of the coming season.

Very truly yours,

A. D. Bache.

Dr. R. M. Patterson, *Pres. American Philos. Society.*

Note upon the Liquified Protoxide of Nitrogen, and its action on Alcohol.

By M. C. Despretz.

Translated for the Journal of the Franklin Institute.

In the lecture upon Physics at the Sorbonne, (13th January,) we threw some liquid protoxide of nitrogen upon a platina capsule at the ordinary temperature, and also upon the same, brought to a red heat. In each case the liquid immediately took the state called spheroidal, and evaporated slowly. Although from known experiments, and especially from the beautiful ones of M. Boutigny upon different substances, and especially upon sulphurous acid, these results might have been anticipated, I thought that it would be interesting to communicate them. It is, moreover, remarkable that a gas which requires a pressure of more than 40 atmospheres to liquify it, should remain liquid upon a red-hot body at atmospheric pressure. It is now probable that all the liquified gases, at least all those which have the property of remaining liquid at atmospheric pressures, will behave similarly.

At the same lecture, having poured the liquified protoxide into a silver capsule placed upon a hot brick, and placed the whole under the recipient of an air pump, we saw, at the first plunge of the piston, the liquid cover itself with a white coating, and soon change into a light mass like flakes of snow. The elasticity under the receiver was reduced to about 2 centimetres. (0·8 inch.)

After the lecture we tried to freeze absolute alcohol. For this purpose, we plunged into the protoxide a thin glass tube containing several grammes of alcohol. This was suspended in a small vessel, in the bottom of which was a paste formed of carbonic acid (solidified) and sulphuric ether, and the concave cover of which, was filled with the same paste. The whole was then placed under the receiver of an air pump. When it was

thought that the refrigerant bodies were nearly evaporated, the tube containing the alcohol was withdrawn, and placed in a horizontal position. The surface of the liquid remained, for several minutes, perpendicular to the axis of the tube, but the alcohol gradually regained its fluidity. I, and all who were present at the experiment, thought that the upper portion of the alcohol was frozen, and that if the experiment had lasted longer, the whole mass would have been frozen. The liquid, in this experiment, did not cease to be limpid. The same alcohol exposed to a current of protoxide, as the gas escaped from the apparatus of Natterer, became very viscous; but the surface was not solidified as in the second experiment.

Want of the protoxide and carbonic acid prevented us from repeating these experiments, and several others connected with the same subject, and particularly that of the comparison of the air and alcohol thermometer. This latter must give very inexact indications of temperature when it begins to lose its fluidity. We shall resume these experiments.

Comptes Rendus de l'Academie des Sciences, 29th Jan., 1849.

Starch from Horse Chesnuts.

M. Belloc stated to the Academy of Sciences of Paris, at their meeting 15th January last, that he had obtained starch, perfectly white and tasteless, from the horse chesnut, by simple washing in cold water and decantation. Articles of food made with it were considered superior to similar ones made with potato starch. With rough apparatus, he obtained 19 to 21 per cent. of starch from the pulp of the fruit, while a comparative experiment gave him but 11·78.

At the meeting on the 22d January, M. Ch. Flandin called the attention of the Academy to the fact, that the specimens of starch from the horse chesnut, presented by M. Belloc, still retained a very perceptible bitter taste; and exhibited another specimen obtained by him, by washing with carbonate of soda, entirely devoid of taste. He stated that the best test of the difference was to cook the products with water, when the heat would be found to develope the acidity of the resinous principle which had not been removed by the washing with water, and decompose it into empyreumatic principles. He had found, by careful experiments, the amount of starch in the horse chesnut to be per cent.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 19th, 1849.

S. V. Merrick, President, presiding.

M. T. W. Chandler, Recording Secretary, *pro tem.*

The minutes of the last meeting were read and approved.

Donations to the Library and Cabinet of Models were presented from—George Escol Sellers, Esq., Cincinnati, Ohio; Solomon W. Roberts, Esq., and Prof. Jno. F. Frazer, Philadelphia; Wm. J. McAlpine, Esq., Brooklyn, New York; and William H. McFarland, Esq., Richmond, Va.